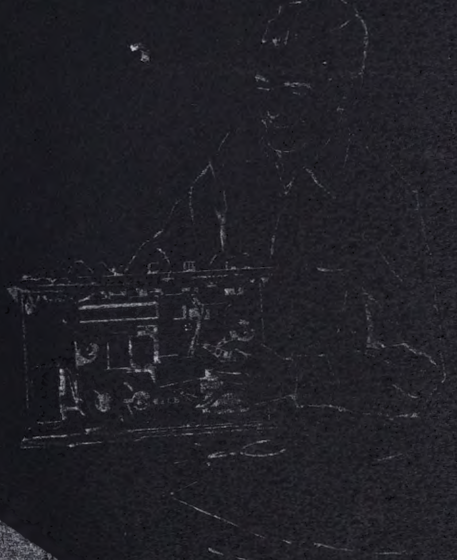


Assembling and Using Your...

Heathkit

"SENECA" AMATEUR TRANSMITTER

MODEL VHF-1

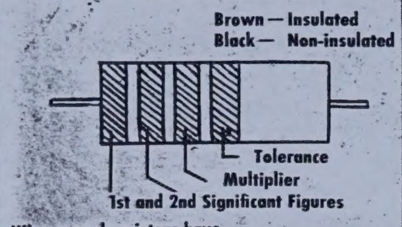
HEATH COMPANY

A Subsidiary of Daystrom Inc.

BENTON HARBOR, MICHIGAN

STANDARD COLOR CODE — RESISTORS AND CAPACITORS

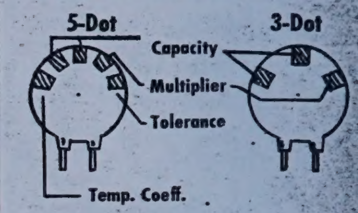
AXIAL LEAD RESISTOR


Brown — Insulated
Black — Non-insulated
Tolerance
Multiplier
1st and 2nd Significant Figures

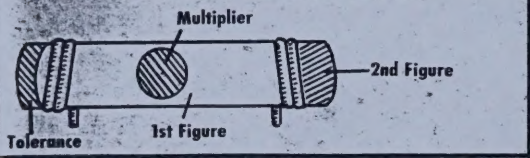
Wire wound resistors have 1st digit band double width

INSULATED UNINSULATED Color	FIRST RING BODY COLOR First Figure	SECOND RING END COLOR Second Figure	THIRD RING DOT COLOR Multiplier
BLACK	0	0	None
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

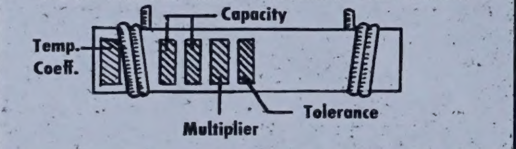
DISC CERAMIC RMA CODE


5-Dot
3-Dot
Capacity
Multiplier
Tolerance
Temp. Coeff.

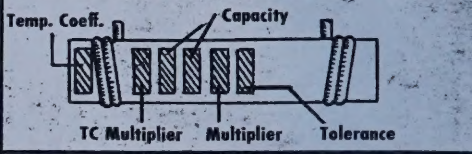
RADIAL LEAD DOT RESISTOR


Multiplier
2nd Figure
1st Figure
Tolerance

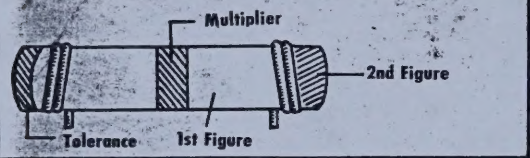
5-DOT RADIAL LEAD CERAMIC CAPACITOR


Capacity
Temp. Coeff.
Tolerance
Multiplier

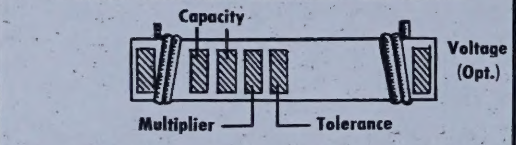
EXTENDED RANGE TC CERAMIC HICAP


Temp. Coeff.
Capacity
TC Multiplier
Multiplier
Tolerance

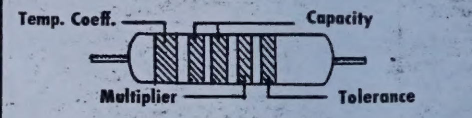
RADIAL LEAD (BAND) RESISTOR


Multiplier
2nd Figure
Tolerance
1st Figure

BY-PASS COUPLING CERAMIC CAPACITOR


Capacity
Voltage (Opt.)
Multiplier
Tolerance

AXIAL LEAD CERAMIC CAPACITOR

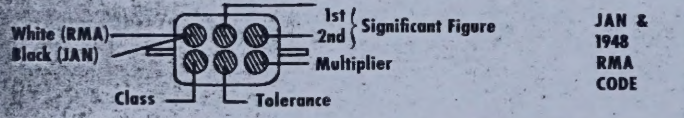

Temp. Coeff.
Capacity
Multiplier
Tolerance

The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

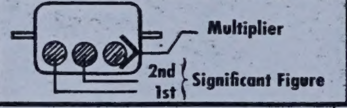
The physical size of carbon resistors is determined by thei wattage rating. Carbon resistors most commonly used in Heath kits are ½ watt. Higher wattage rated resistors when specifie are progressively larger in physical size. Small wire wounc resistors ½ watt, 1 or 2 watt may be color coded but the firs band will be double width.

MOLDED MICA TYPE CAPACITORS

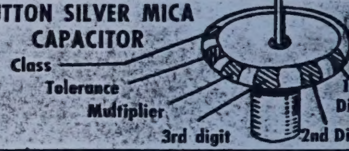
CURRENT STANDARD CODE


White (RMA)
Black (JAN)
1st
2nd
Significant Figure
Multiplier
Class
Tolerance
JAN & 1948 RMA CODE

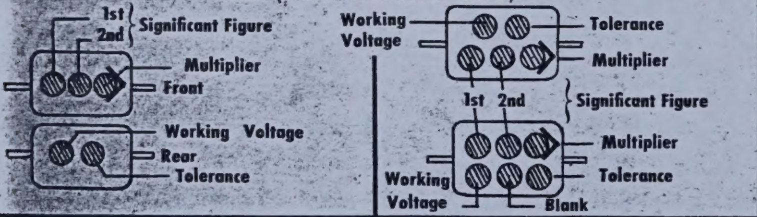
RMA 3-DOT (OBSOLETE)
RATED 500 W.V.D.C. ± 20% TOL.


Multiplier
2nd
1st
Significant Figure

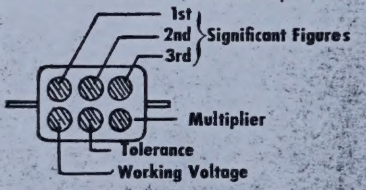
BUTTON SILVER MICA CAPACITOR


Class
Tolerance
Multiplier
3rd digit
Di
2nd Di

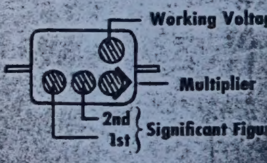
RMA (5-DOT OBSOLETE CODE)


1st
2nd
Significant Figure
Multiplier
Front
Working Voltage
Rear
Tolerance
Working Voltage
Tolerance
Multiplier
1st
2nd
Significant Figure
Multiplier
Tolerance
Working Voltage
Blank

RMA 6-DOT (OBSOLETE)

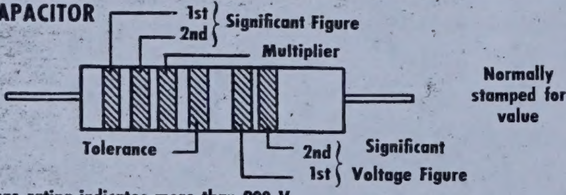

1st
2nd
3rd
Significant Figures
Multiplier
Tolerance
Working Voltage

RMA 4-DOT (OBSOLETE)


Working Volta
Multiplier
2nd
1st
Significant Figu

MOLDED PAPER TYPE CAPACITORS

TUBULAR CAPACITOR

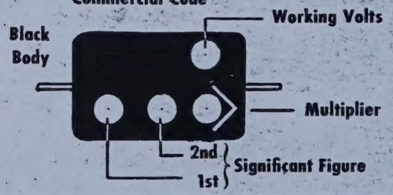

1st
2nd
Significant Figure
Multiplier
Normally stamped for value
Tolerance
2nd
1st
Significant Voltage Figure

A 2 digit voltage rating indicates more than 900 V. Add 2 zeros to end of 2 digit number.

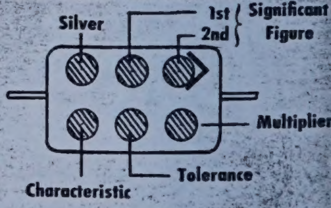
W9OAC

MOLDED FLAT CAPACITOR

Commercial Code


Black Body
Working Volts
Multiplier
2nd
1st
Significant Figure

JAN. CODE CAPACITOR


Silver
1st
2nd
Significant Figure
Multiplier
Tolerance
Characteristic

The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

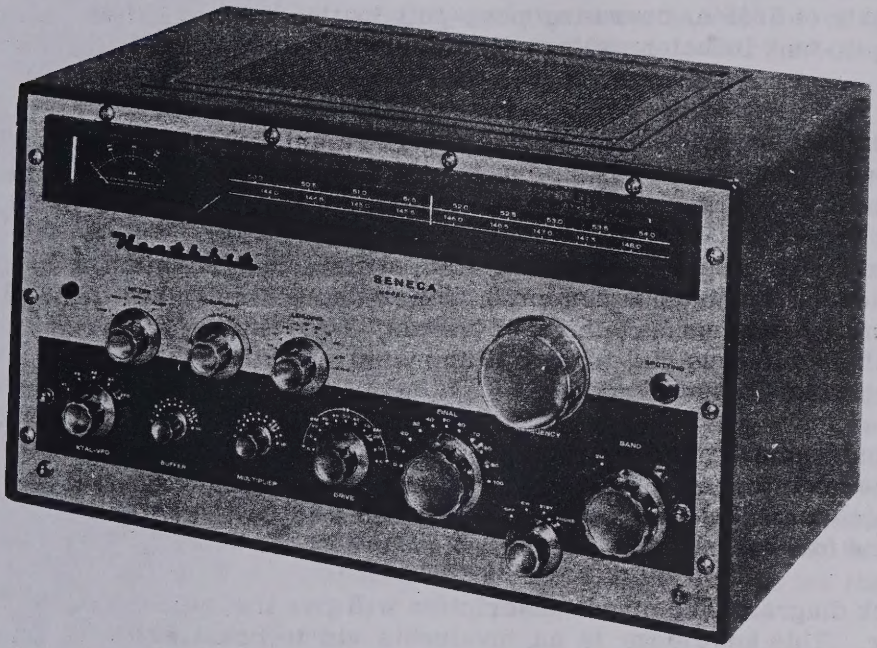
In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Courtesy of Centrala

8-13-62

ASSEMBLY AND OPERATION OF THE HEATHKIT "SENECA" AMATEUR TRANSMITTER

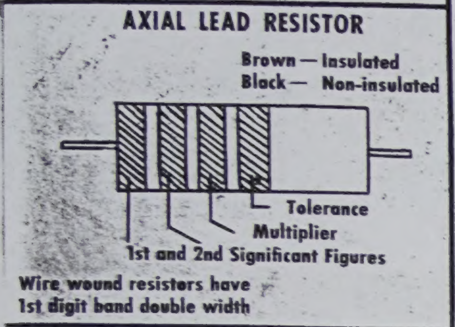
MODEL VHF-1



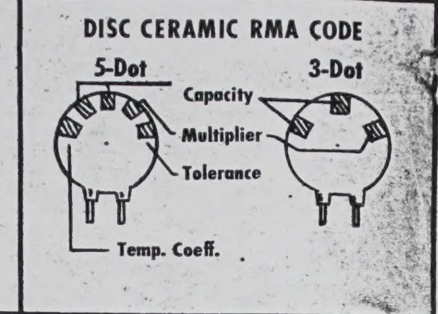
SPECIFICATIONS

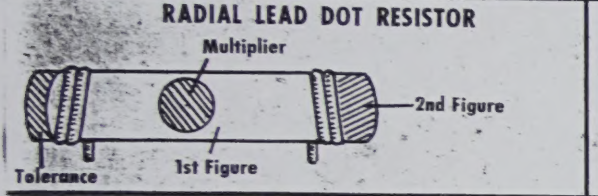
Power Input:	6 meters 140 watts CW, 120 watts Phone (peak) 2 meters 110 watts CW, 95 watts Phone (peak)
Output Impedance:	50-72 Ω (non-reactive)
Output Coupling:	Link (coaxial)
Operation:	Crystal-VFO, CW-Phone
Band Coverage:	50-54 MC, 144-148.3 MC
Audio:	Screen modulated, controlled carrier
Tube Complement:	5R4GY HV rectifier 5V4G LV rectifier OA2 voltage regulator 12AX7 speech amplifier 6DE7 modulator, carrier control 6AU6 VFO 6AN8 crystal oscillator-multiplier 2E26 driver 2-6146 push-pull power amplifier 6AQ5 clamp
Power Requirements:	117 volts AC, 60 cycles
Standby (phone, CW):	120 watts
Full load (phone, CW):	400 watts (intermittent)
Cabinet Size:	16 5/8" wide x 10 1/8" high x 10" deep
Net Weight:	50 lbs.
Shipping Weight:	62 lbs.

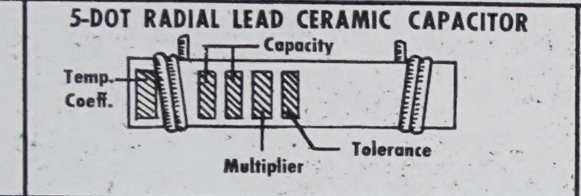
STANDARD COLOR CODE — RESISTORS AND CAPACITORS

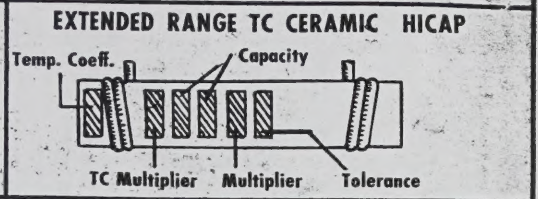

AXIAL LEAD RESISTOR
Brown — Insulated
Black — Non-insulated
Tolerance
Multiplier
1st and 2nd Significant Figures
Wire wound resistors have
1st digit band double width

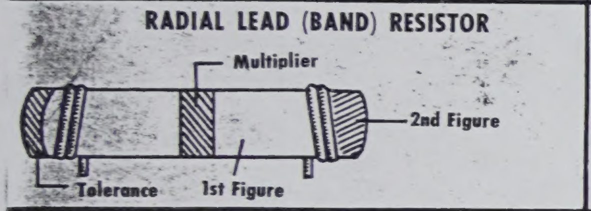
INSULATED UNINSULATED Color	FIRST RING BODY COLOR First Figure	SECOND RING END COLOR Second Figure	THIRD RING DOT COLOR Multiplier
BLACK	0	0	None
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

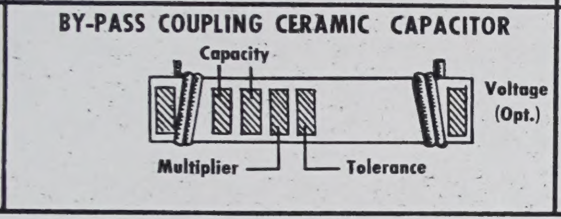

DISC CERAMIC RMA CODE
5-Dot
3-Dot
Capacity
Multiplier
Tolerance
Temp. Coeff.

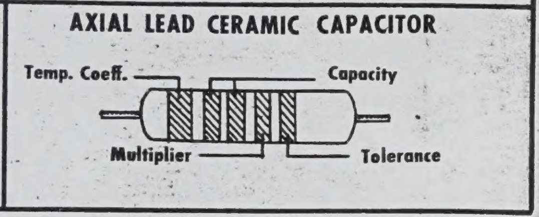

RADIAL LEAD DOT RESISTOR
Multiplier
2nd Figure
Tolerance
1st Figure


5-DOT RADIAL LEAD CERAMIC CAPACITOR
Capacity
Temp. Coeff.
Tolerance
Multiplier


EXTENDED RANGE TC CERAMIC HICAP
Temp. Coeff.
Capacity
TC Multiplier
Multiplier
Tolerance


RADIAL LEAD (BAND) RESISTOR
Multiplier
2nd Figure
Tolerance
1st Figure

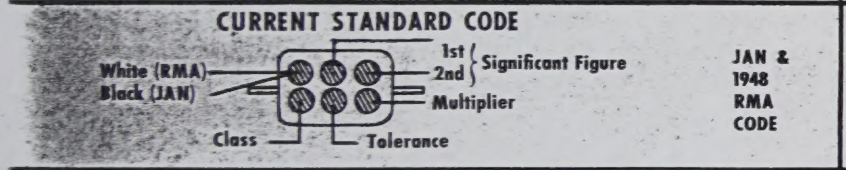

BY-PASS COUPLING CERAMIC CAPACITOR
Capacity
Voltage (Opt.)
Multiplier
Tolerance

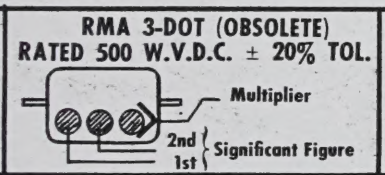

AXIAL LEAD CERAMIC CAPACITOR
Temp. Coeff.
Capacity
Multiplier
Tolerance

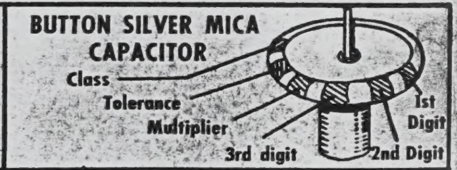
The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

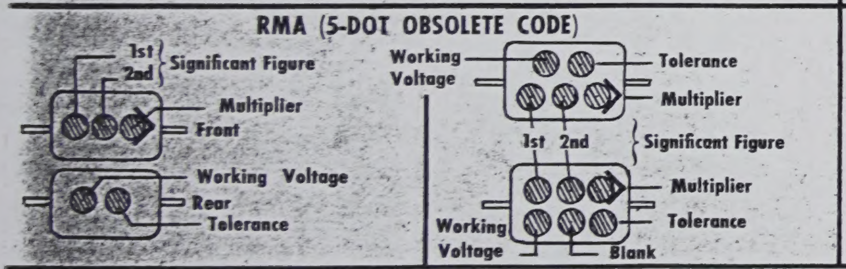
The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are ½ watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors ½ watt, 1 or 2 watt may be color coded but the first band will be double width.

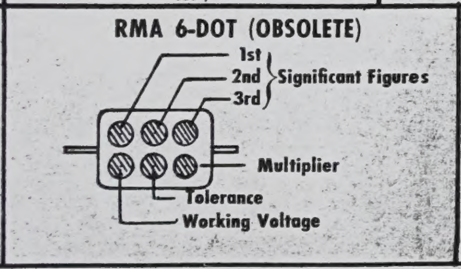
MOLDED MICA TYPE CAPACITORS

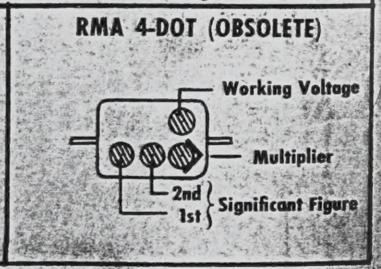

CURRENT STANDARD CODE
White (RMA)
Black (JAN)
1st
2nd
Significant Figure
Multiplier
Class
Tolerance
JAN & 1948 RMA CODE


RMA 3-DOT (OBSOLETE)
RATED 500 W.V.D.C. ± 20% TOL.
Multiplier
2nd
1st
Significant Figure

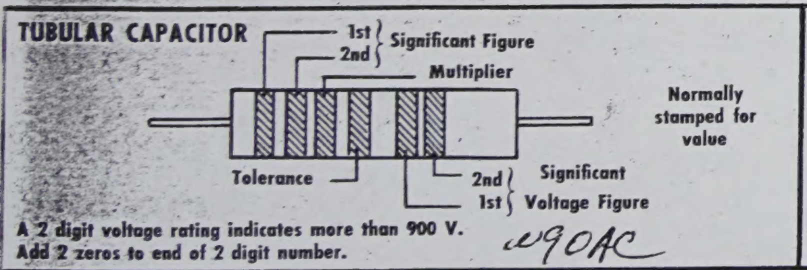

BUTTON SILVER MICA CAPACITOR
Class
Tolerance
Multiplier
3rd digit
1st Digit
2nd Digit


RMA (5-DOT OBSOLETE CODE)
1st
2nd
Significant Figure
Multiplier
Front
Working Voltage
Rear
Tolerance
Working Voltage
Tolerance
Multiplier
1st 2nd
Significant Figure
Multiplier
Tolerance
Working Voltage
Blank


RMA 6-DOT (OBSOLETE)
1st
2nd
3rd
Significant Figures
Multiplier
Tolerance
Working Voltage

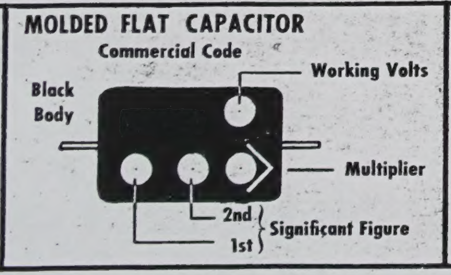

RMA 4-DOT (OBSOLETE)
Working Voltage
Multiplier
2nd
1st
Significant Figure

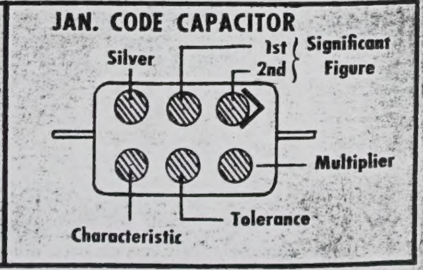
MOLDED PAPER TYPE CAPACITORS


TUBULAR CAPACITOR
1st
2nd
Significant Figure
Multiplier
Normally stamped for value
Tolerance
2nd
1st
Significant Voltage Figure

A 2 digit voltage rating indicates more than 900 V.
Add 2 zeros to end of 2 digit number.

w90AC


MOLDED FLAT CAPACITOR
Commercial Code
Black Body
Working Volts
Multiplier
2nd
1st
Significant Figure


JAN. CODE CAPACITOR
Silver
1st
2nd
Significant Figure
Multiplier
Characteristic
Tolerance

The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Courtesy of Centralab

HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

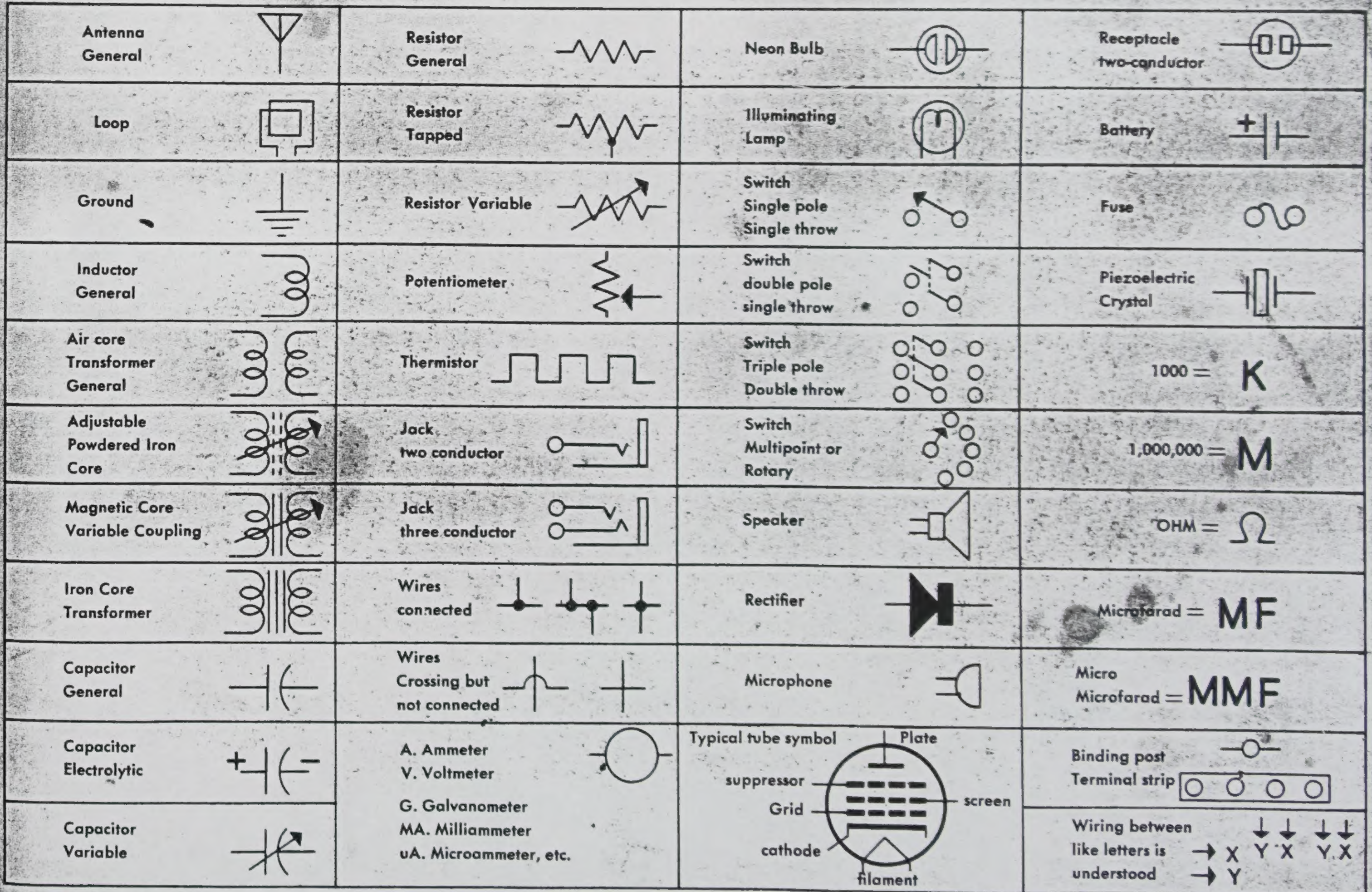
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.

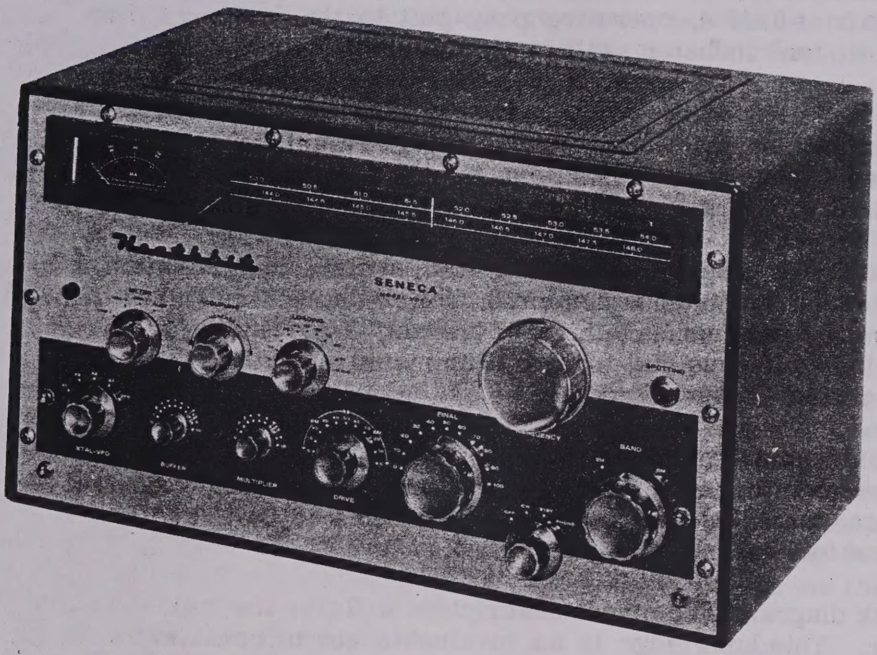

Antenna General
Loop
Ground
Inductor General
Air core Transformer General
Adjustable Powdered Iron Core
Magnetic Core Variable Coupling
Iron Core Transformer
Capacitor General
Capacitor Electrolytic
Capacitor Variable
Resistor General
Resistor Tapped
Resistor Variable
Potentiometer
Thermistor
Jack two conductor
Jack three conductor
Wires connected
Wires Crossing but not connected
A. Ammeter
V. Voltmeter
G. Galvanometer
MA. Milliammeter
uA. Microammeter, etc.
Neon Bulb
Illuminating Lamp
Switch Single pole Single throw
Switch double pole single throw
Switch Triple pole Double throw
Switch Multipoint or Rotary
Speaker
Rectifier
Microphone
Typical tube symbol
Plate
suppressor
Grid
screen
cathode
filament
Receptacle two-conductor
Battery
Fuse
Piezoelectric Crystal
1000 = K
1,000,000 = M
OHM = Ω
Microfarad = MF
Micro Microfarad = MMF
Binding post
Terminal strip
Wiring between like letters is understood
X Y X Y X

Courtesy of I. R. E.

8-13-62

ASSEMBLY AND OPERATION OF THE HEATHKIT "SENECA" AMATEUR TRANSMITTER

MODEL VHF-1



SPECIFICATIONS

Power Input:	6 meters 140 watts CW, 120 watts Phone (peak) 2 meters 110 watts CW, 95 watts Phone (peak)
Output Impedance:	50-72 Ω (non-reactive)
Output Coupling:	Link (coaxial)
Operation:	Crystal-VFO, CW-Phone
Band Coverage:	50-54 MC, 144-148.3 MC
Audio:	Screen modulated, controlled carrier
Tube Complement:	5R4GY HV rectifier 5V4G LV rectifier OA2 voltage regulator 12AX7 speech amplifier 6DE7 modulator, carrier control 6AU6 VFO 6AN8 crystal oscillator-multiplier 2E26 driver 2-6146 push-pull power amplifier 6AQ5 clamp
Power Requirements:	117 volts AC, 60 cycles
Standby (phone, CW):	120 watts
Full load (phone, CW):	400 watts (intermittent)
Cabinet Size:	16 5/8" wide x 10 1/8" high x 10" deep
Net Weight:	50 lbs.
Shipping Weight:	62 lbs.

INTRODUCTION

The Heathkit Model VHF-1 "Seneca" Transmitter was designed to extend the transmitting complement of the amateur radio station into the VHF region. It features up to 120 watts input on phone and 140 watts input on CW in the 6-meter band. In the 2-meter band, these ratings are reduced slightly to prolong final amplifier tube life. It includes controlled carrier phone operation, has built-in VFO for both 6 and 2 meters, and four switch-selected crystal positions. Panel controls allow VFO or crystal control, phone or CW operation on both amateur bands.

The "Seneca" consists of two power supplies, five radio frequency stages, and two dual-triode audio stages. A pair of 6146's, operating push-pull in the final amplifier, uses quarter wave tuned lines or a split-tank inductor, with a tunable link output coupling for 50 or 72 Ω transmission line.

Complete RF shielding from the VFO circuit to the final amplifier is incorporated in this Transmitter. Feed-through type bypass capacitors are used on all power leads entering the RF compartments for greater TVI protection and transmitter stability.

The front panel controls consist of an Xtal-VFO switch, meter switch, two antenna loading controls (antenna tuning and antenna coupling), buffer tuning, multiplier tuning, driver tuning, final amplifier tuning, function switch, band switch, VFO tuning, and a spotting push button switch. The VFO slide rule type dial is edge illuminated and with vernier tuning provides ample bandspread and accurate frequency settings.

The mike connector, output connector, key jack, and auxiliary socket are located on the rear chassis apron. The auxiliary socket is so connected to allow remote control of the Transmitter such as using voice control with a Heathkit Voice Control Unit, and also has connections for receiver muting and for operating an antenna relay.

The following block diagram and circuit description will give the builder a better understanding of the Transmitter. This knowledge is an invaluable aid to construction and as such, is well worth reading thoroughly.

IN A TRANSMITTER OF THIS SIZE, LETHAL VOLTAGES ARE PRESENT. CONSEQUENTLY, GREAT CARE MUST BE EXERCISED WHEN ANY TESTS OR ADJUSTMENTS ARE MADE.

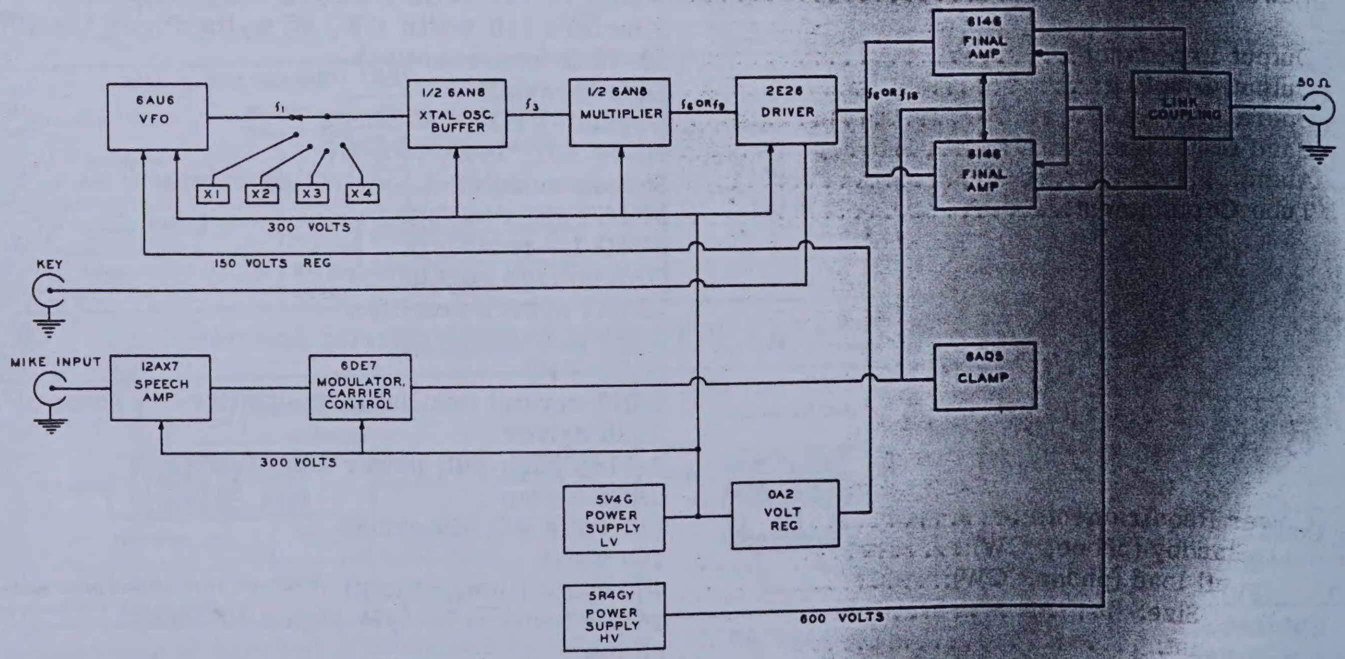

6AU6
VFO
f_1
X1
X2
X3
X4
1/2 6AN8
XTAL OSC.
BUFFER
f_3
1/2 6AN8
MULTIPLIER
f_6 OR f_9
2E26
DRIVER
f_6 OR f_{18}
6146
FINAL
AMP
6146
FINAL
AMP
LINK
COUPLING
50 Ω
300 VOLTS
150 VOLTS REG
KEY
MIKE INPUT
12AX7
SPEECH
AMP
6DE7
MODULATOR,
CARRIER
CONTROL
6AQ5
CLAMP
300 VOLTS
5V4G
POWER
SUPPLY
LV
0A2
VOLT
REG
5R4GY
POWER
SUPPLY
HV
600 VOLTS

Figure 1

CIRCUIT DESCRIPTION

VFO

The VFO circuit consists of a 6AU6 tube operating as a Clapp oscillator in the frequency ranges of 8.000 to 8.222 mc and 8.333 to 9.000 mc. Undue heating effects are prevented by mounting the tube on top and outside of the VFO enclosure. Also, the VFO subchassis is located away from all other heat generating components in the final assembly to further decrease heating effects upon the enclosure. A double bearing ceramic insulated dual tuning capacitor is used as the frequency control. The dual capacitor, consisting of two stator assemblies of different capacity, permits a large bandspread on both bands. Two ceramic insulated air trimmers for bandspread adjustment prevent initial drift during calibration.

The VFO frequency determining coil (L-1) is wound on a heavy ceramic slug-tuned form, heavily doped and baked. This combination achieves high-Q, low drift, and decreases the effect of humidity. A temperature compensating capacitor (C-1) of the negative type is mounted in close proximity to the coil. Thus, a rise in temperature of the coil will increase the inductance, and this same temperature rise will decrease the capacity of the temperature compensating capacitor. By properly proportioning these components, the effects of one cancel the other and the frequency remains constant with a change in temperature.

The VFO switch has solid coin silver contacts for minimum of contact resistance and long life. It is operated by a linkage mechanism on the band switch, which correlates the VFO output frequency with the band in use.

The Clapp or series-tuned Colpitts oscillator circuit is a high-Q circuit obtained by tapping the tube across only a small portion of the oscillating tank circuit, resulting in very loose coupling between tube and circuit. Three capacitors connected in series across the coil (consisting of the two large fixed value capacitors (C-3, C-4) and the tuning capacitor with their respective padding capacitors in parallel) provide the taps across which the tube is connected. These large capacitances also lessen the effect of input tube capacitance upon frequency. The 6AU6 tube essentially operates as an electron-coupled oscillator with the tube's screen grid as the oscillator plate. The screen grid voltage is stabilized at 150 volts by an OA2 regulator in the power supply. With the screen grid operating as the oscillator plate, the actual tube plate is coupled to the oscillator only by the electron stream in the tube and is further shielded from the oscillator by the grounded suppressor grid. This effectively isolates the oscillator circuit from the following stages and lessens the effect of loading on the VFO frequency.

The output of the VFO is also band switched between two slug-tuned coils (L-2 and L-3), tuned with the distributed capacity of the coaxial cable which is fed to one position of the Xtal-VFO switch in the multiplier subchassis. A 47 Ω resistor (R-2), in series with the output coils, broadens the circuit and therefore the RF output voltage from one end to the other of both bands is fairly constant in amplitude.

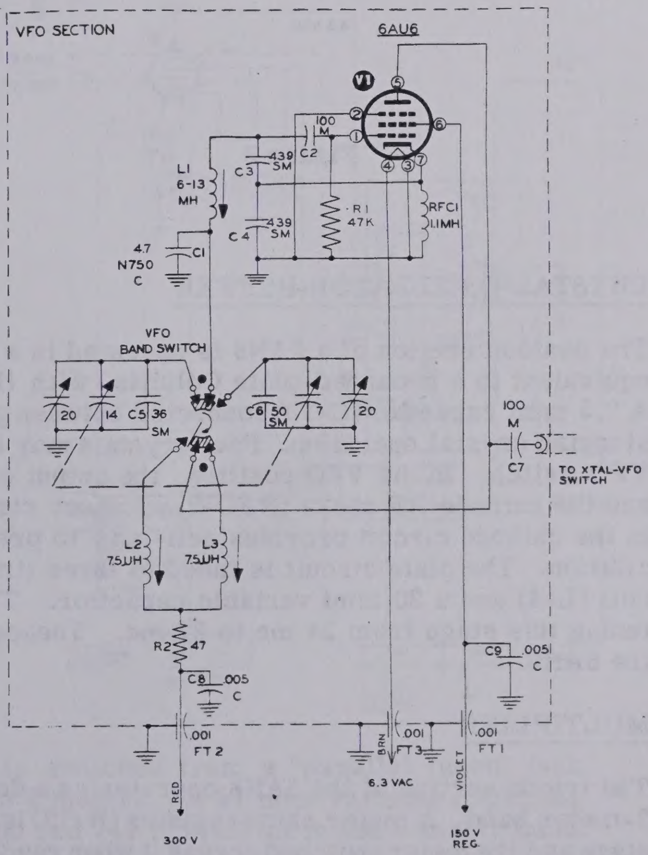
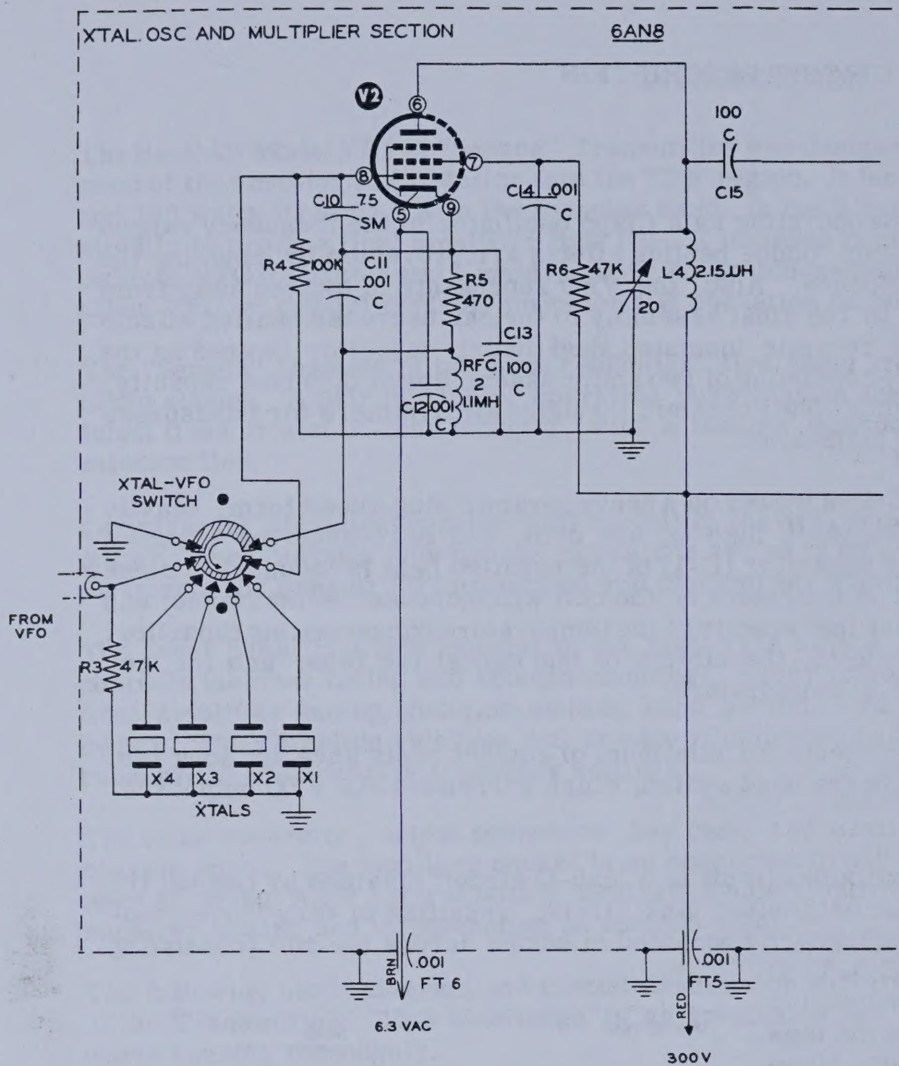
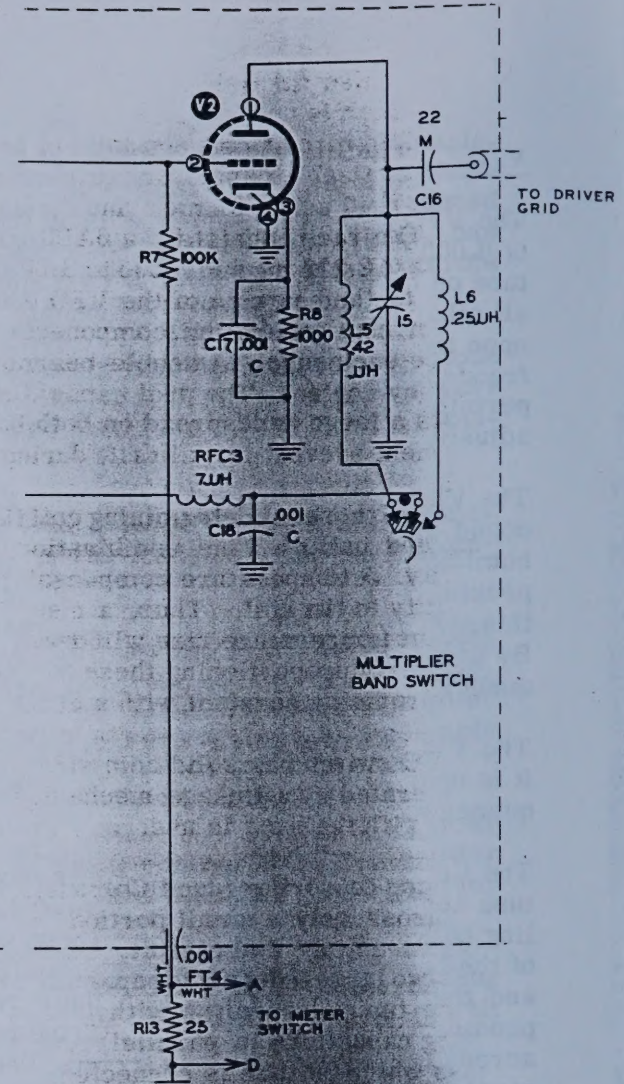


Figure 2



XTAL. OSC AND MULTIPLIER SECTION
6AN8
V2
6
7
8
5
9
100
C
C15
C10 7.5
SM
C14 .001
C
R4 100K
C11
.001
C
R5
470
R6 47K
L4 2.15 UH
20
C13
100
C
RFC
2
1.1MH
C12 .001
C
XTAL-VFO
SWITCH
FROM
VFO
R3 47K
X4
X3
X2
X1
XTALS
BRN
.001
FT 6
6.3 VAC
.001
FT5
RED
300V

Figure 3



V2
1
2
3
22
M
C16
TO DRIVER
GRID
R7 100K
C17 .001
C
R8
1000
L5
.42
UH
15
L6
.25 UH
RFC3
7 UH
C18
.001
C
MULTIPLIER
BAND SWITCH
.001
FT4
WHT
WHT
R13 25
A
D
TO METER
SWITCH

Figure 4

CRYSTAL OSCILLATOR-BUFFER

The pentode section of a 6AN8 is operated in a tuned-plate circuit, the oscillating circuit being equivalent to a grounded-plate Colpitts, with the crystals connected between grid and ground. A 7.5 mmf capacitor (C-10) connected between grid and cathode increases excitation and prevents sluggish crystal operation. Four crystals may be switched into the circuit by means of the Xtal-VFO switch. In the VFO position, the output of the VFO is connected between grid and ground and the cathode RF choke (RFC-2) is short circuited in this position. A 470 Ω resistor (R-5) in the cathode circuit provides self-bias to prevent exceeding plate dissipation with loss of excitation. The plate circuit is tuned to three times the input frequency with an air wound high-Q coil (L-4) and a 20 mmf variable capacitor. The capacitor is brought out to the front panel for tuning this stage from 24 mc to 27 mc. The output is capacity coupled to the triode section of the 6AN8.

MULTIPLIER

The triode section of the 6AN8 operates as a doubler to the 6-meter band and as a tripler for the 2-meter band. A meter shunt resistor (R-13) is permanently connected in the grid circuit of this stage and the meter switched across it when reading drive from the crystal oscillator-buffer stage.

This stage also has self-bias, using a 1 KΩ resistor (R-8) in the cathode circuit. The multiplier switch, which is operated by a linkage mechanism on the band switch, switches the B+ voltage for the plate circuit between two tank coils. With the multiplier switch in the 6-meter position, a 15 mmf variable capacitor, which is brought out to the front panel, tunes the 6-meter tank coil (L-5) from 50 mc to 54 mc. In the 2-meter position, the same 15 mmf variable capacitor tunes the 2-meter tank coil (L-6) from 72 mc to 74.15 mc. An RF choke (RFC-3), in series with the tank coils, prevents RF from feeding back into the B+ line. The output of this stage is capacity coupled to the driver stage through a coaxial cable. Both the crystal oscillator-buffer and second multiplier circuits are completely enclosed for shielding and all leads entering the subchassis assembly are bypassed with feed-through type capacitors.

DRIVER

A 2E26 operates straight through on six meters, and doubles to two meters to drive the final amplifier. As in the preceding stage, grid drive is measured and the stage is self-biased. Cathode keying is employed with the cathode circuit being connected to the key jack. It is also connected to the spotting push button switch and the function switch. Closing the key, depressing the spotting push button switch, or placing the function switch in phone position all complete the cathode circuit to ground to put the stage into operation.

Due to the fact that the driver operates straight through on 6 meters, more than ample drive is provided so it is necessary to reduce this drive to prevent damage to the grids of the final amplifier. This is accomplished by reducing the screen voltage to the 2E26 by means of a voltage divider network, consisting of a 23.5 KΩ resistor (R-11) which is connected in series with a 10 KΩ resistor (R-12) through the driver band switch. With the band switch in the 2-meter position, the 10 KΩ resistor is disconnected and normal screen voltage is applied for maximum output from this stage. By properly proportioning the two values of screen voltages, the drive appearing at the grids of the final amplifier will be approximately the same on both bands.

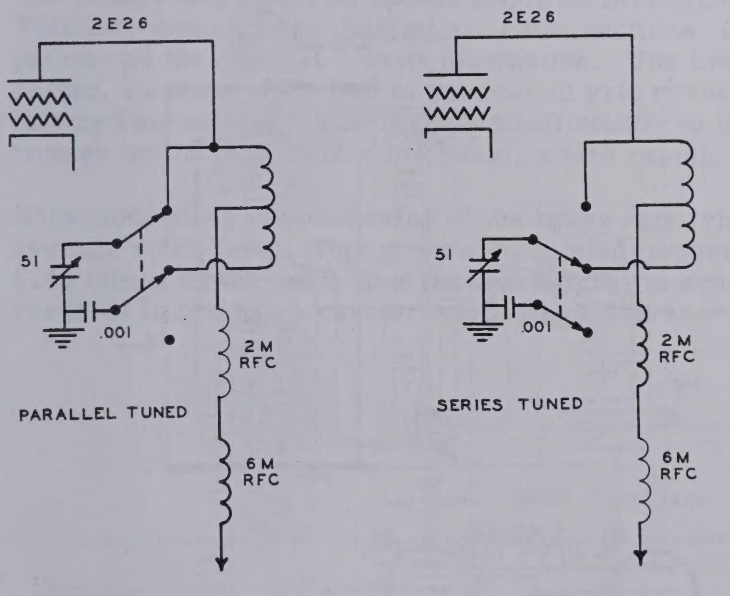

2E26
51
.001
2 M
RFC
6 M
RFC
PARALLEL TUNED
2E26
51
.001
2 M
RFC
6 M
RFC
SERIES TUNED

Figure 5

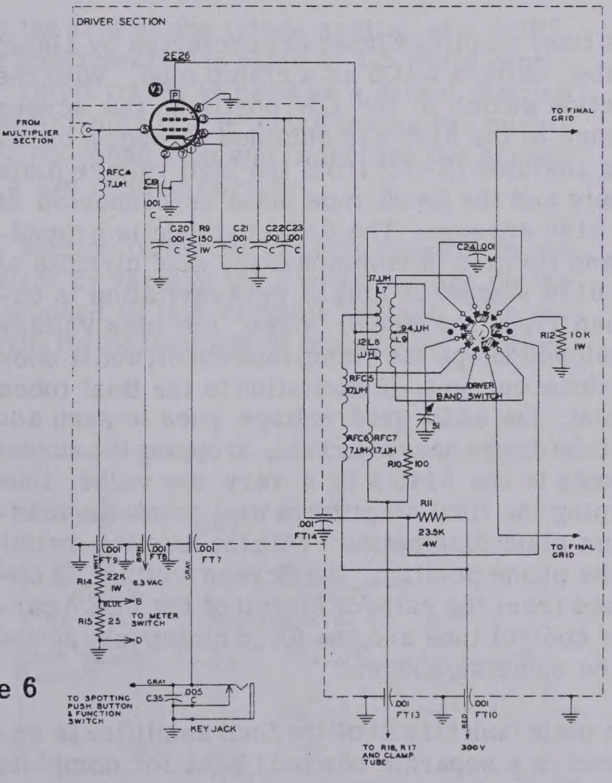

DRIVER SECTION
2E26
V3
P
FROM
MULTIPLIER
SECTION
TO FINAL
GRID
RFC4
7µH
C19
.001
C
C20
.001
C
R9
150
1W
C21
.001
C
C22
.001
C
C23
.001
C
C24 .001
M
.17µH
L7
.94µH
L9
.12 L8
µH
RFC5
.17µH
R12
10K
1W
DRIVER
BAND SWITCH
51
RFC6
7µH
RFC7
.17µH
R10
100
R11
23.5K
4W
.001
FT14
TO FINAL
GRID
.001
FT9
.001
FT8
.001
FT7
WHT
BRN
GRAY
R14
22K
1W
6.3 VAC
BLUE
B
R15
25
TO METER
SWITCH
D
GRAY
.005
C35
C
TO SPOTTING
PUSH BUTTON
& FUNCTION
SWITCH
KEY JACK
.001
FT13
.001
FT10
RED
TO R16, R17
AND CLAMP
TUBE
300 V

Figure 6

Referring to Figure 5, the plate circuit of the 2E26 is switched from a "parallel tuned" tank circuit on 6 meters to a "series tuned" tank circuit on 2 meters. A 51 mmf variable capacitor tunes this circuit from 50 to 54 mc in the 6-meter band and 144 to 148.3 mc in the 2-meter band.

A 2-meter RF choke (RFC-5) which is connected to the low potential RF point on the tank coil offers high impedance to the 2-meter energy and a 6-meter RF choke (RFC-6) connected in series with the 2-meter RF choke offers high impedance to the 6-meter energy.

The output of the driver stage is transformer coupled to the grids of the final amplifier tubes. This stage is also completely shielded, using feed-through type capacitors for all leads entering the compartment.

FINAL AMPLIFIER

Two 6146 type tubes operate in push-pull in the final amplifier stage which operates straight through on both bands.

The grid circuits are switched between two grid tank coils, one which is tuned to 6 meters (L-9) and the other which is tuned to 2 meters (L-8), using the input capacities of the final tubes. Both coils are mounted on the driver band switch wafer using inductive coupling for maximum energy transfer from the driver stage. In addition, these double tuned circuits help to reject high order oscillator and multiplier harmonics.

Neutralization is employed on both bands for maximum stability of the final amplifiers. The self-neutralizing frequency of the 6146 is in the neighborhood of 100 mc, making a switched neutralization circuit mandatory. With the band switch in the 6-meter position, conventional cross-neutralization is employed, but with the band switch in the 2-meter position, neutralization is accomplished by increasing the effective grid-to-plate capacitance of each tube in order to cancel the screen-lead inductance. With the 6146's operating in the 2-meter band, the screen-lead inductance becomes quite appreciable, allowing a considerable amount of energy leak-through from plate to grid even though the screen is carefully bypassed. Screen neutralization could have been employed, but because of its frequency sensitivity, another operating control would be required.

The final amplifier tubes are protected by clamp action, using a 6AQ5 as a clamp tube. With the function switch in the CW position, the screen voltage to the 6146's is obtained through a dropping resistor (R-32) from the high voltage plate supply and the 6AQ5 tube plate is connected at the 6146 screens. The 6AQ5 cathode is grounded and its grid is common to the grid circuits of the 6146 stage. As long as grid excitation is obtained from the driver stage, the bias voltage developed keeps the clamp tube cut off and it does not draw current. If excitation to the final tubes is lost, the 6AQ5 grid voltage goes to zero and the tube draws heavy current, dropping the screen voltage to the 6146's to a very low value, thus keeping the final amplifiers well below the maximum plate dissipation. With the function switch in the phone position, the screen voltage is obtained from the cathode circuit of the 6DE7 carrier control tube and the 6AQ5 clamp tube action is the same as above.

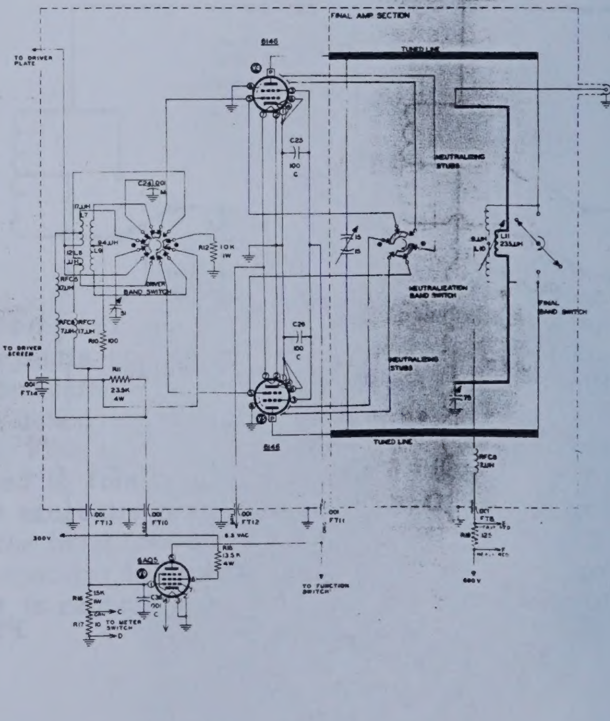

FINAL AMP SECTION
TO DRIVER PLATE
6146
V4
TUNED LINE
RF OUT
C25
100
C
NEUTRALIZING STUBS
C24 .001
M
17µH
L7
24µH
L9
12 L8
1µH
R12 10K
1W
15
15
9µH
L10
L11
23µH
RFC5
12µH
DRIVER BAND SWITCH
31
NEUTRALIZATION BAND SWITCH
FINAL BAND SWITCH
RFC6 RFC7
7µH 17µH
R10 100
C26
100
C
TO DRIVER SCREEN
R11
23.5K
4W
NEUTRALIZING STUBS
.001
FT14
75
V5
P
TUNED LINE
6146
RFC8
2µH
.001
FT13
.001
FT10
.001
FT12
.001
FT11
.001
FT8
300V
6.3 VAC
R18
13.5K
4W
R19
125
6AQ5
V9
R16
15K
1W
C30
.001
C
R17
10
TO METER SWITCH
C
D
TO FUNCTION SWITCH
E
F
600V

Figure 7

The plate tank circuit of the final amplifier is enclosed in a separate compartment for complete shielding and to reduce radiation loss from the tuned lines. The plate circuit is composed of a shorted quarter-wave section of transmission line for the 2-meter band. A double ended knife action type switch (final band switch) located at the ends of the silver plated tuned lines acts as the shorting bar and is connected to the band switch linkage mechanism. With the band switch in the 6-meter position, the tuned lines are unshorted and merely act as extended plate leads for the 6-meter split tank coil. The 6-meter tank coil also acts as a pair of 2-meter RF chokes connected at the low potential RF point on the tuned lines when operating on 2 meters. The tuned lines and the tank coil are resonated at the tube end by a "butterfly" type variable capacitor. The rotor of the "butterfly" capacitor is left ungrounded to prevent possible stray resonances and parasitic oscillations that may appear higher than the operating frequency.

Quarter-wave tuned lines were chosen over half-wave tuned systems because of the space limitations and also the fact that in push-pull circuits, the third order harmonic is prominent. Thus, a strong third harmonic of 50 megacycle energy from the final amplifier could result using a half-wave system.

Link coupling is used on both bands by the use of a dual purpose link. A one turn coil in the center of the hairpin loop couples into the center of the 6-meter tank coil, and the hairpin loop coupling to the end of the tuned lines. The RF output is fed to a coaxial jack on the rear apron of the Transmitter and a 75 mmf variable capacitor connected between the link and ground tunes out any reactance that may be present.

MODULATOR

A 12AX7 tube is used as a high gain two stage resistance coupled speech amplifier. The output of the speech amplifier is coupled to the 6DE7 through a low capacity coupling capacitor (C-30). This low capacity coupling, along with the 470 K resistor (R-27) and 100 mmf capacitor (C-31) which forms the feedback circuit from the modulator cathode back to the speech amplifier cathode, shapes the response to favor the voice frequencies, thus allowing a higher average level to be maintained where it will be the most effective.

The audio energy from the speech amplifier is coupled to the grid of one triode section of a 6DE7. This tube contains two dissimilar triode sections. One triode section is rated at 1.5 watts dissipation and the other at 7 watts dissipation. The lower rated triode is used as a direct coupled driver, its plate being tied to the control grid of the heavier duty triode which forms the modulator. This second triode is biased sufficiently to limit its conduction and therefore the screen voltage on the final is of a low value, which results in a low resting carrier.

With modulation the conduction of the heavy duty triode section is varied in accordance with the average voice level. This gives a controlled carrier effect by varying the screen voltage on the 6146 tubes, at the same time the audio signal is superimposed on this variable voltage. The net result is to produce a carrier output which increases with the percentage of modulation applied.

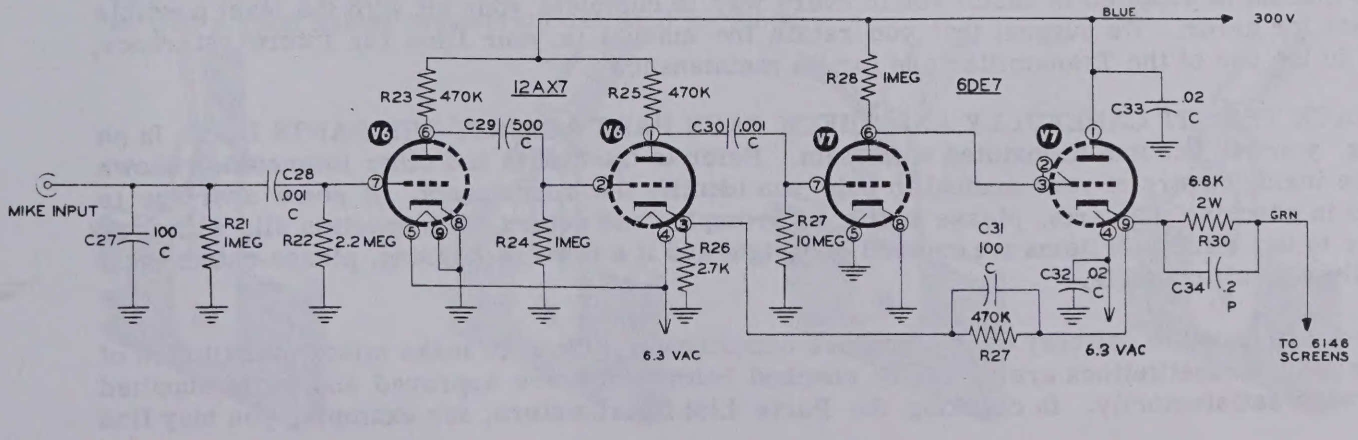


Figure 8

POWER SUPPLIES

A single transformer is utilized for both the high voltage and low voltage power supplies. It also contains all of the filament windings.

The low voltage supply uses a 5V4G rectifier with a choke input filter which delivers 300 volts at 125 ma to the modulator and all RF sections, except the final amplifier.

The high voltage supply consists of a 5R4GY rectifier, choke input filter, two 125 mfd electrolytic capacitors in series, and a center-tapped bleeder resistor which also balances the series capacitors.

The two 125 mfd 450 volt electrolytic capacitors connected in series result in a filter capacity of 62.5 mfd at 900 volts, offering sufficient capacity for good dynamic regulation under varying load conditions and a good safety factor on voltage breakdown. The use of paper or oil capacitors becomes impractical at these values of capacity. The supply delivers 600 volts at 250 ma to the plates of the final amplifier.

Both sides of the AC line are fused in a special line plug and all circuits entering or leaving the transmitter chassis with 117 volts AC on them are bypassed with special AC line bypass capacitors.

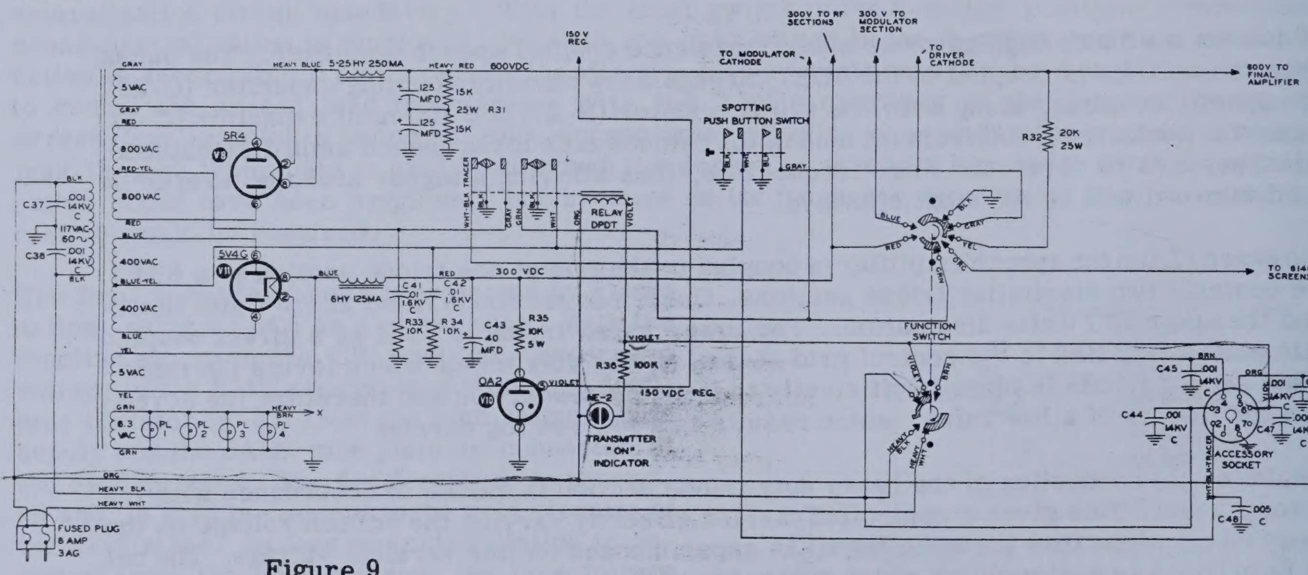

150 V REG.
300V TO RF SECTIONS
300 V TO MODULATOR SECTION
TO MODULATOR CATHODE
TO DRIVER CATHODE
600V TO FINAL AMPLIFIER
GRAY
HEAVY BLUE
5-25 HY 250 MA
HEAVY RED
600VDC
5 VAC
RED
800 VAC
RED-YEL
800 VAC
5R4
V8
125 MFD
15K
25W R31
125 MFD
15K
SPOTTING PUSH BUTTON SWITCH
BLK
WHT
R32
20K
25W
BLK
C37
.001 14KV C
117VAC 60~
C38
.001 14KV C
BLK
WHT-BLK TRACER
GRAY
GRN
ORG
RELAY DPDT
VIOLET
BLUE
GRAY
YEL
ORG
GRN
TO 6146 SCREENS
BLUE
400 VAC
BLUE-YEL
400 VAC
5V4G
V11
6HY 125MA
C41 .01 1.6KV C
C42 .01 1.6KV C
300 VDC
R33 10K
R34 10K
C43 40 MFD
R35 10K 5W
VIOLET
R36 100K
150 VDC REG.
FUNCTION SWITCH
YEL
5 VAC
OA2
V10
NE-2
TRANSMITTER "ON" INDICATOR
GRN
6.3 VAC
PL 1
PL 2
PL 3
PL 4
HEAVY BRN
X
ORG
HEAVY BLK
HEAVY WHT
BRN
C45 .001 14KV C
C46 .001 14KV C
C44 .001 14KV C
C47 .001 14KV C
ACCESSORY SOCKET
WHT-BLK-TRACER
C48 .005 C
FUSED PLUG
8 AMP
3AG

Figure 9

CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. We suggest that you retain the manual in your files for future reference, both in the use of the Transmitter and for its maintenance.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with them. Refer to the charts and other information shown on the inside covers of your manual to help you identify the components. If some shortage is found in checking the parts, please notify us promptly and return the inspection slip with your letter to us. Hardware items are counted by weight and if a few are missing, please obtain them locally if at all possible.

In order to expedite delivery to you, we are occasionally forced to make minor substitution of parts. Such substitutions are carefully checked before they are approved and parts supplied will work satisfactorily. In checking the Parts List for resistors, for example, you may find that a resistor with a 5% tolerance has been substituted for a resistor with a 10% tolerance, as shown on the Parts List. These changes are self-evident and are mentioned here only to prevent confusion in checking the contents of your kit.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -50% are common for electrolytic capacitors.

PROPER SOLDERING TECHNIQUES

Only a small percentage of Heathkit purchasers find it necessary to return an instrument for factory service. Of these instruments, by far the largest proportion of malfunctions are due to poor or improper soldering.

Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

For most wiring, a 30 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly over the joint. Keep the iron tip clean and bright by wiping it from time to time with a piece of steel wool or a cloth.

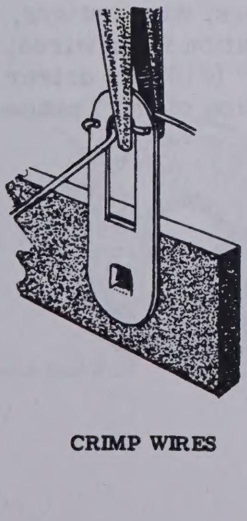
WIRING AND SOLDERING PROCEDURE

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

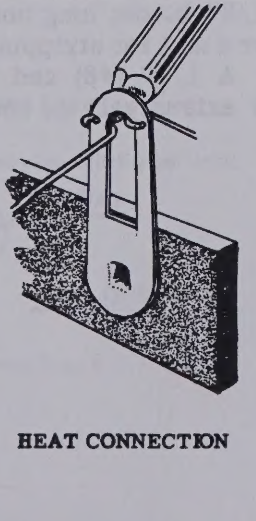
1. Unless otherwise indicated, all wire used is insulated (hookup wire). If bare wire is to be covered with insulating sleeving, the instructions will state "Use sleeving".

2. Leads on resistors, capacitors and transformers are generally much longer than they need to be to make the indicated connection. In these cases, cut the lead off as specified in the step when connecting the part because in VHF equipment excessive lead length could impair operation.

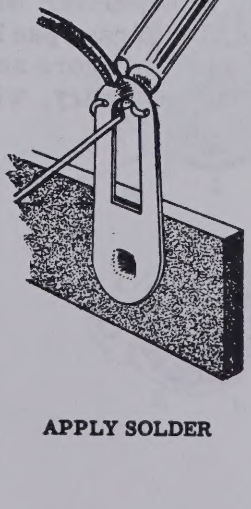
3. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the wire is too large to allow bending, position the wire so that a good solder connection can still be made.



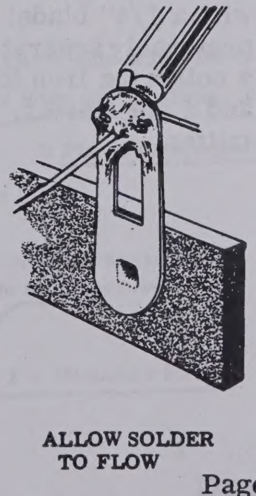
CRIMP WIRES



HEAT CONNECTION



APPLY SOLDER



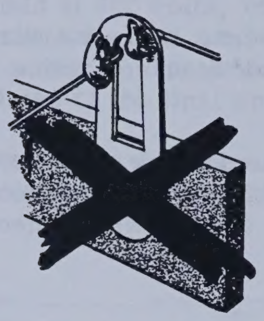
ALLOW SOLDER TO FLOW

4. Position the work, if possible, so that gravity will help to keep the solder where you want it.

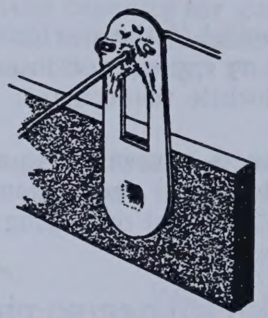
5. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.

6. Then place the solder against the heated terminal and it will immediately flow over the joint, using only enough solder to thoroughly wet the junction; it is usually not necessary to fill the entire hole in the terminal with solder.

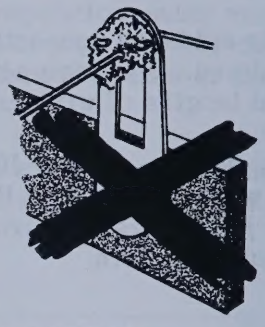
7. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.



COLD SOLDER
CONNECTION INSUFFICIENTLY
HEATED



PROPER SOLDER
CONNECTION



COLD SOLDER
CONNECTION MOVED
WHILE COOLING

A poor or cold solder joint will usually look crystalline and have a grainy texture, or will stand up in a blob, and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth, bright appearance.

We suggest that you do the following before work is started:

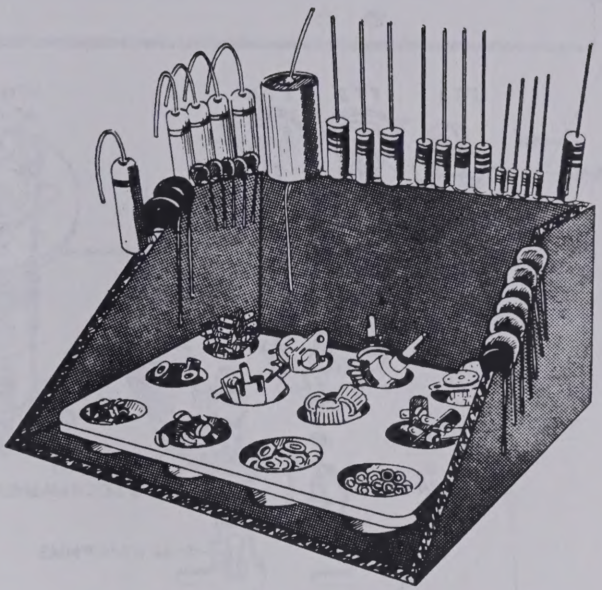
1. Attach the large fold-in pictorials to the wall above your work bench.

2. Read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations.

3. Lay out all parts in a work area that will not have to be cleared or disturbed if your work should be interrupted.

4. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long nose pliers; wire cutters, preferably separate diagonal cutters; a pen knife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder. A 1/4" (#8) and a 5/16" (#10) nut driver and a nut starter, while not necessary, will aid extensively in construction of the Transmitter.

Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends stuck in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.



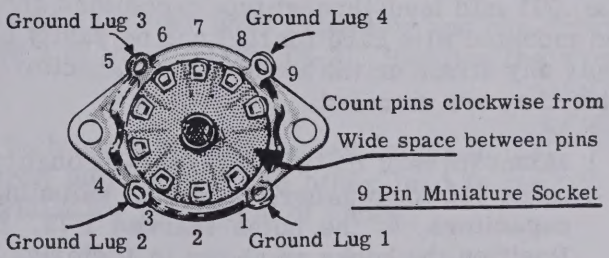
Some builders have also found a magnetized screwdriver to be handy for picking up small parts, such as lockwashers. The magnetized screwdriver may also be used to position small parts in "tight corners". A very simple way to magnetize a screwdriver is to stroke the magnet of an inexpensive speaker a few times.

STEP-BY-STEP PROCEDURE

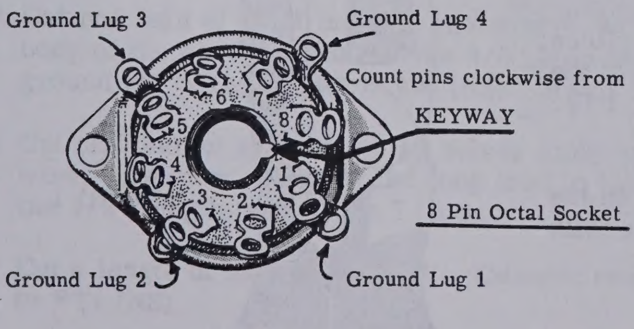
The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have also found it helpful to mark each lead in colored pencil on the Pictorial as it is added.

The abbreviation "NS" indicates that a connection should not be soldered as yet for other wires may need to be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in question before it is soldered. For example, if the instruction reads, "Connect one lead of a 47 KΩ resistor to lug 1 (S-2)", it will be understood that there will be two leads connected to the terminal at the time it is soldered. This additional check will help avoid errors.

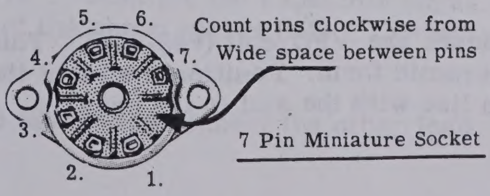
NOTE: On miniature sockets, the numbering of the socket is determined by starting clockwise from the left of the blank terminal space. On octal sockets, the numbering is determined in the same way from the keyway. Ground lugs which are on tube sockets are also numbered the same way. All sockets are numbered from the bottom chassis view.


Ground Lug 3
6
7
8
Ground Lug 4
5
9
Count pins clockwise from
Wide space between pins
4
3
2
1
Ground Lug 2
Ground Lug 1

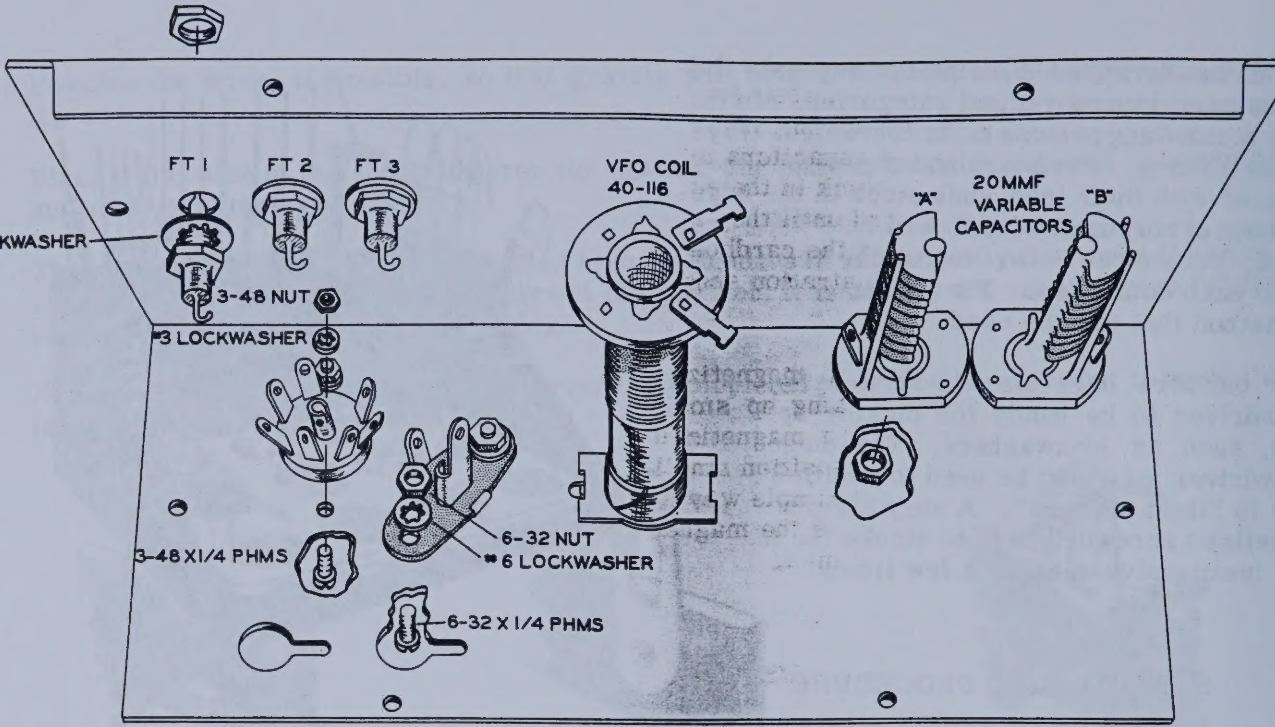
9 Pin Miniature Socket


Ground Lug 3
Ground Lug 4
Count pins clockwise from
KEYWAY
1
2
3
4
5
6
7
8
Ground Lug 2
Ground Lug 1

8 Pin Octal Socket


5.
6.
Count pins clockwise from
Wide space between pins
4.
7.
3.
2.
1.

7 Pin Miniature Socket


FT 1
FT 2
FT 3
#12 LOCKWASHER
3-48 NUT
#3 LOCKWASHER
VFO COIL
40-116
"A"
20MMF
VARIABLE
CAPACITORS
"B"
3-48 X 1/4 PHMS
6-32 NUT
#6 LOCKWASHER
6-32 X 1/4 PHMS

Pictorial 1

VFO SUBASSEMBLY

"L" Bracket

( ) Mount the 7-pin ceramic tube socket with the wide pin spacing located as shown in Pictorial 1. Use 3-48 x 1/4" hardware with #3 lockwashers under the nuts.

( ) Mount the phono socket, using 6-32 x 1/4" hardware with #6 lockwashers under the nuts.

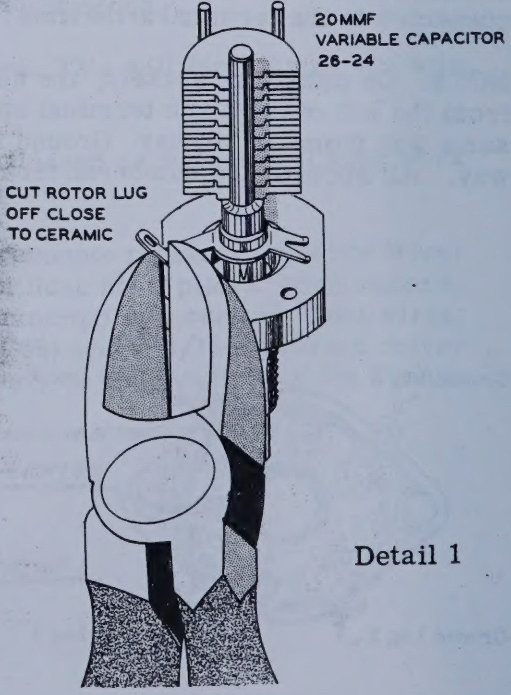
( ) Cut off the rotor lugs on two of the 20 mmf variable capacitors (#26-24). Refer to Detail 1.

( ) Mount the two 20 mmf variable capacitors as shown in Pictorial 1, using the nuts supplied with the units. Notice that the stators are mounted facing away from each other.

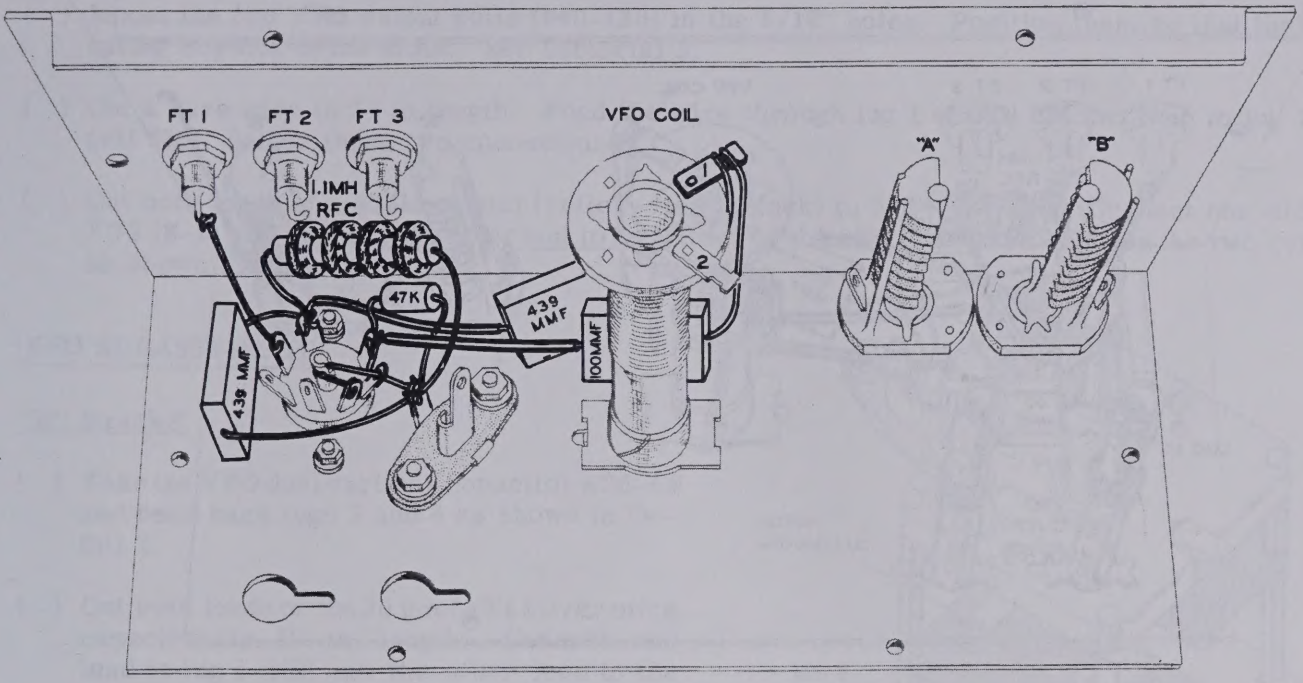
The .001 mfd feed-through type capacitors should be handled and mounted with care for they can be easily broken. Do not apply any strain on the hooks of the capacitors, particularly after they are mounted.

( ) Mount three of the .001 mfd feed-through type capacitors, using #12 lockwashers under the mounting flange of the capacitors, at the holes marked FT1, FT2 and FT3. Position the hooks as shown in Pictorial 1.

( ) Mount the VFO coil (#40-116). This is the coil on the ceramic form. Position it so that the locating pin falls in line with the slot in the chassis.


20MMF
VARIABLE CAPACITOR
26-24
CUT ROTOR LUG
OFF CLOSE
TO CERAMIC

Detail 1



Pictorial 2

( ) Connect a #20 (small) bare wire from pin 3 of tube socket V1 through the center post, through pin 2, and then connect to the ground lug of the phono socket. Refer to Pictorial 2. Solder pin 3 and pin 2.

NOTE: All bare wire used is #20 (small) unless otherwise specified.

( ) Cut both leads of a 47 KΩ 1/2 watt resistor (yellow-violet-orange) to 1/2" and bend the leads to right angles to the resistor body. Connect one lead to pin 1 of V1 (NS), and the other lead to the ground lug of the phono socket (NS).

NOTE: All resistors are 1/2 watt unless otherwise specified.

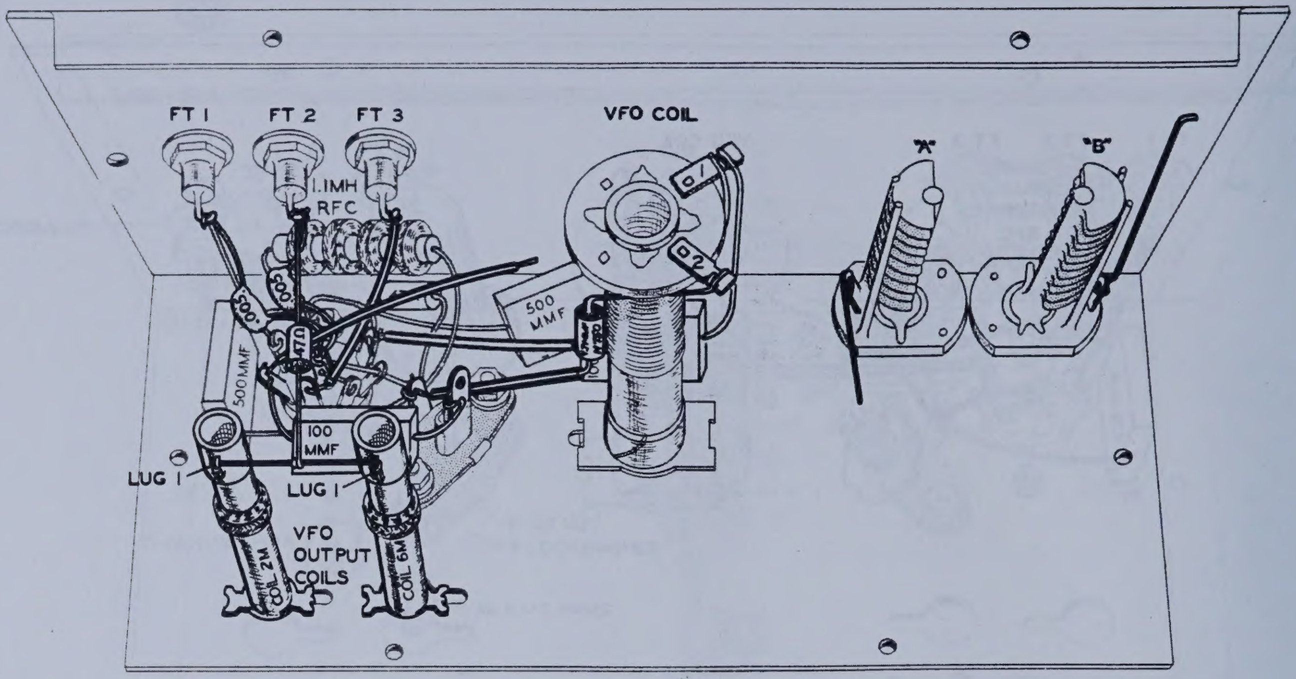
( ) Cut one lead of a 100 mmf silver mica capacitor (brown-black-brown) to 1" in length. Slip a 5/8" length of sleeving over this lead and connect to pin 1 of V1 (S-2). Connect the other lead to lug 1 of the VFO coil (NS).

( ) Slip a 1" length of sleeving over one lead of a 439 mmf 1% silver mica capacitor and connect to pin 7 of V1 (NS). Connect the other lead to lug 1 of the VFO coil (S-2). Position the capacitor as shown.

( ) Cut one lead of a 1.1 mh RF choke to 5/8". Bend both leads to right angles, close to the body of the choke. Connect the 5/8" lead to pin 7 (NS) and connect the other lead to the ground lug of the phono socket (NS). Refer to Pictorial 2 for placement of choke.

( ) Cut one lead of a 439 mmf 1% silver mica capacitor to 1/2". Position the capacitor edgewise, as shown. Connect the long lead to the ground lug of the phono socket (NS). Connect the 1/2" length lead to pin 7 (S-3).

( ) Cut a length of bare wire to 1". Connect one end to pin 6 (S-1), and connect the other lead to FT1 (NS).



Pictorial 3

( ) Cut both leads of a .005 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to the center post of V1 (NS), and the other lead to FT1 (S-2), as shown in Pictorial 3.

( ) Cut both leads of a .005 mfd disc ceramic capacitor to 1/2" in length. Connect one lead to the center post of V1 (S-3), and connect the other lead to FT2 (NS).

( ) Cut a length of bare wire to 1 1/2". Connect one end to pin 4 (S-1). Slip a 1 1/8" length of sleeving on this wire and connect the other end to FT3 (S-1).

( ) Cut both leads of the 4.7 mmf (N750) ceramic tubular capacitor to 1" in length. Slip a 3/4" length of sleeving over one of the leads and connect to the ground lug of the phono socket (S-5). Referring to Pictorial 3, lay the body of the capacitor against the windings on the VFO coil and connect the other lead to lug 2 of the VFO coil (NS).

( ) Now position the 1.1 mh RF choke so that its windings are not touching the chassis, tube socket pins, or other components.

( ) Cut one lead of a 100 mmf silver mica capacitor (brown-black-brown) to 5/8" and the other lead to 1/2". Connect the 1/2" length lead to the center lug of the phono socket (S-1). Connect the other lead to pin 5 of the tube socket (NS). Position the capacitor as shown.

( ) Cut a bare wire to a length of 2 1/8". Connect one end to pin 5 (S-2). Slip a 1 3/4" length of sleeving on this wire. The other end will be connected later.

( ) Cut a bare wire to 1 3/8" in length and connect one end to the stator lug on the 20 mmf variable capacitor "B" (S-1). Form a right angle bend on the other end of the wire, as shown. This end will be connected later.

( ) Cut a bare wire to 5/8" in length and connect one end to the stator lug on the other 20 mmf variable capacitor "A" (S-1). Form this lead at right angles to the capacitor and parallel to the chassis, as shown. The other end will be connected later.

( ) Mount the two VFO output coils (#40-135) in the 5/16" holes. Position them so that the locating key fits in the slots. See Pictorial 3.

( ) Cut a bare wire to 1" in length. Feed the wire through lug 1 of coil 2M and then to lug 1 of coil 6M. Solder these two connections.

( ) Cut both leads of a 47 Ω resistor (yellow-violet-black) to 5/8" in length. Connect one end to FT2 (S-2) and connect the other end to the center of the wire connected between the two coils, as shown (S-1).

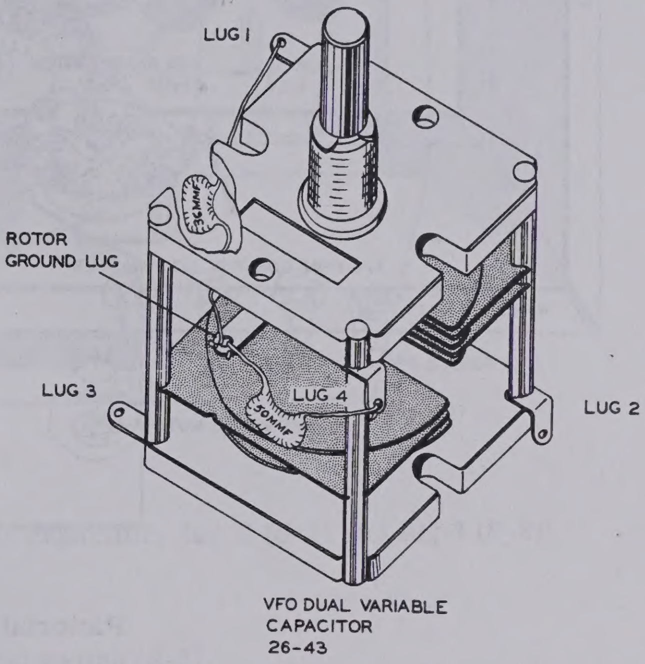
VFO SUBASSEMBLY

"U" Bracket

( ) Take the VFO dual variable capacitor (#26-43) and bend back lugs 2 and 4 as shown in Detail 2.

( ) Cut both leads of the 36 mmf ±5% silver mica capacitor to 1" in length. Connect one lead to lug 1 (NS) and the other lead to the rotor ground lug (NS) of the VFO dual variable capacitor. Position the mica capacitor as shown in Detail 2. Make sure it lays flat on the ceramic and does not obstruct the movement of the rotor plates.

( ) Cut both leads of the 50 mmf ±5% silver mica capacitor to 3/8" in length and connect one lead to lug 4 (S-1) of the VFO capacitor and connect the other lead to the rotor ground lug (S-2). Refer to Detail 2.



Detail 2

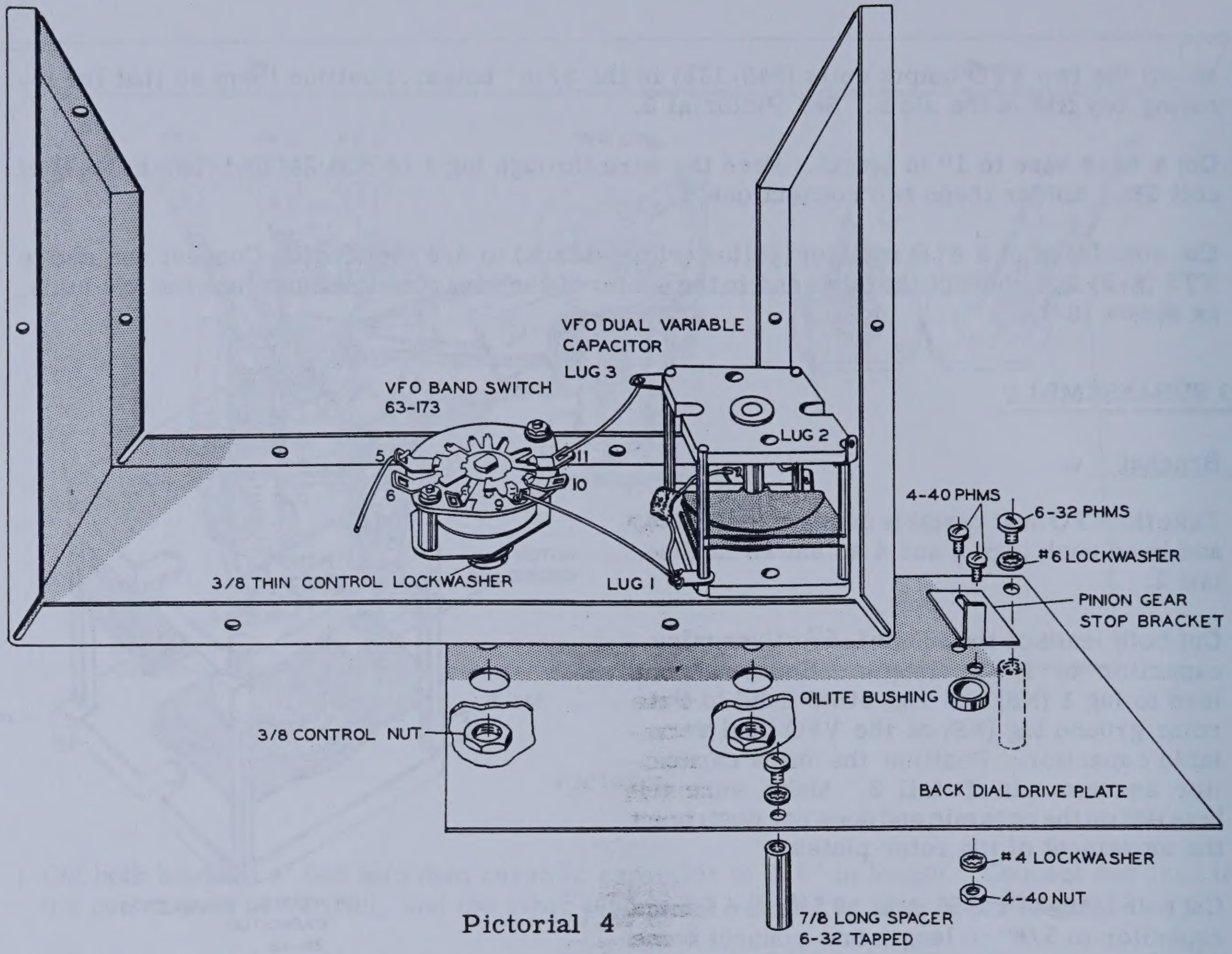
( ) Locate the back dial drive plate. This is the flat rectangular plate with an Oilite bushing assembled to it.

( ) Mount the VFO dual variable capacitor to the U bracket, and at the same time mount the back dial drive plate, as shown in Pictorial 4 on page 16. Position the capacitor as shown and secure temporarily with a 3/8" control nut. Do not use a lockwasher.

( ) Mount the VFO band switch (#63-173) to the U bracket and back dial drive plate, using 3/8" thin control lockwasher, and secure temporarily with a 3/8" control nut.

( ) Take the L and U brackets and temporarily fit the two units together as shown in Pictorial 5 on page 17. Position the band switch so that lug 10 of the band switch and lug 2 of the VFO coil overlap for soldering. Now remove the L bracket and proceed with the preliminary wiring of the U bracket.

NOTE: When soldering switch lugs, position the work so that the solder flows away from the spring contacts. Also, do not use too much solder and do not overheat. If a mistake in wiring is made and a lead has to be removed from a switch lug, just cut the lead loose, particularly if it was crimped on the lug. Excessive heat or solder may damage the switch contacts.


VFO DUAL VARIABLE CAPACITOR
LUG 3
VFO BAND SWITCH 63-173
LUG 2
5
11
6
10
7
9
4-40 PHMS
6-32 PHMS
#6 LOCKWASHER
3/8 THIN CONTROL LOCKWASHER
LUG 1
PINION GEAR STOP BRACKET
OILITE BUSHING
3/8 CONTROL NUT
BACK DIAL DRIVE PLATE
#4 LOCKWASHER
4-40 NUT
7/8 LONG SPACER 6-32 TAPPED

Pictorial 4

( ) Cut a bare wire to 1" in length and connect one end to lug 11 of the VFO band switch (S-1). Connect the other end to lug 3 of the VFO capacitor (NS).

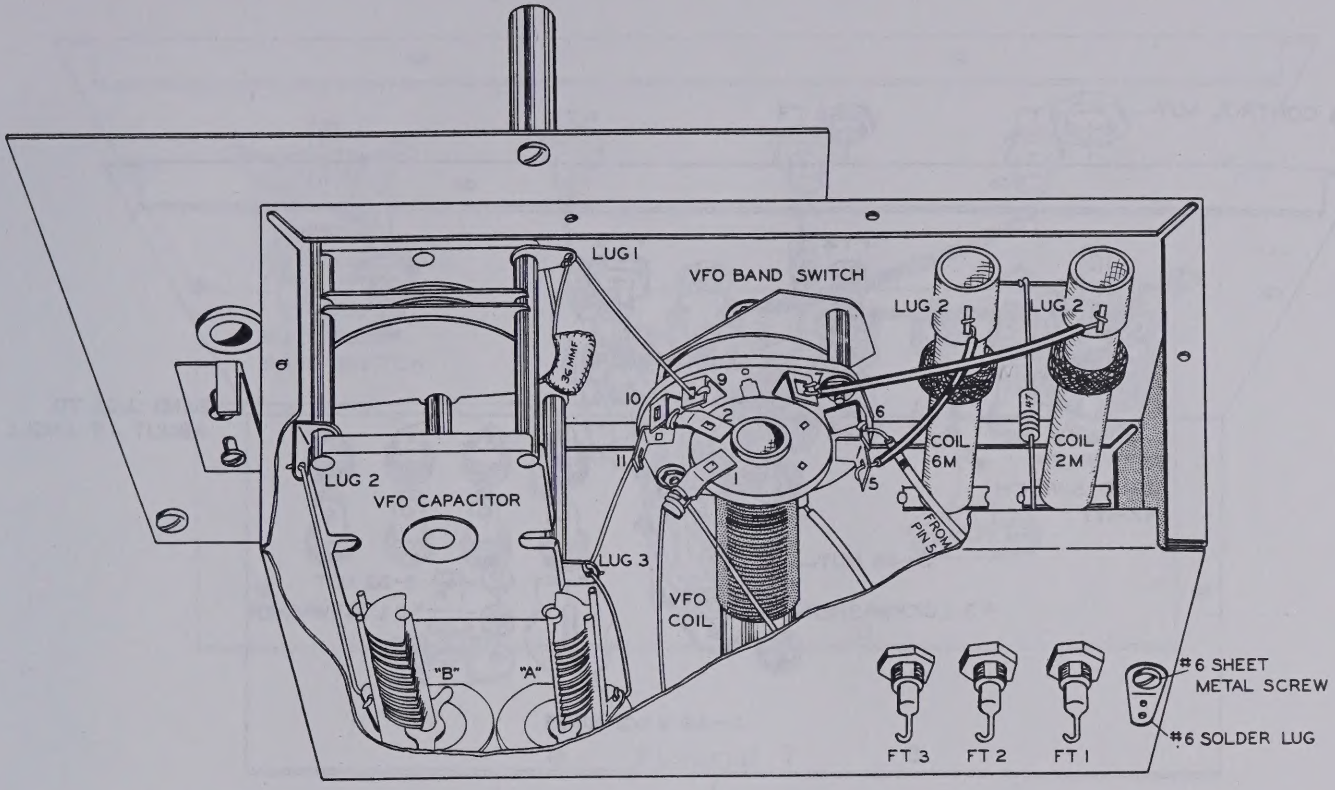
( ) Cut a bare wire to 1 1/8" in length and connect one end to lug 9 of the VFO band switch (S-1). Connect the other end to lug 1 (S-2) of the VFO capacitor.

( ) Cut a bare wire to 7/8" in length and connect one end to lug 5 (S-1) of the VFO band switch. The other end will be connected later.

( ) Locate the pinion gear stop bracket and mount it on the back dial drive plate, using 4-40 x 1/4" screws with #4 lockwashers under the nuts, as shown in Pictorial 4. Position the bracket so that the stop cam is adjacent to the Oilite bushing.

( ) Locate the three 7/8" long spacers and mount at the three 5/32" holes on the dial plate, as shown, using 6-32 x 1/4" screws with #6 lockwashers under the screw heads.

( ) Take the L and U brackets of the VFO subassembly and fit the two units together, as shown in Pictorial 5. Slip the lead from capacitor "A" into lug 3 of the VFO capacitor and the lead from capacitor "B" into lug 2 of the VFO capacitor. Also slip the lead from pin 5 of the tube socket into lug 6 of the VFO band switch. Fasten the two brackets together, using five 6-32 self tapping screws with a #6 solder lug under the screw adjacent to FT1.


LUG 1
VFO BAND SWITCH
LUG 2
LUG 2
36 MMF
9
10
2
7
6
11
1
5
COIL 6M
COIL 2M
FROM PIN 5
LUG 2
VFO CAPACITOR
LUG 3
VFO COIL
"B"
"A"
#6 SHEET METAL SCREW
#6 SOLDER LUG
FT 3
FT 2
FT 1

Pictorial 5

( ) Now solder the following connections: on the VFO capacitor, lug 2 (S-1) and lug 3 (S-2); on the VFO band switch, lug 6 (S-1).

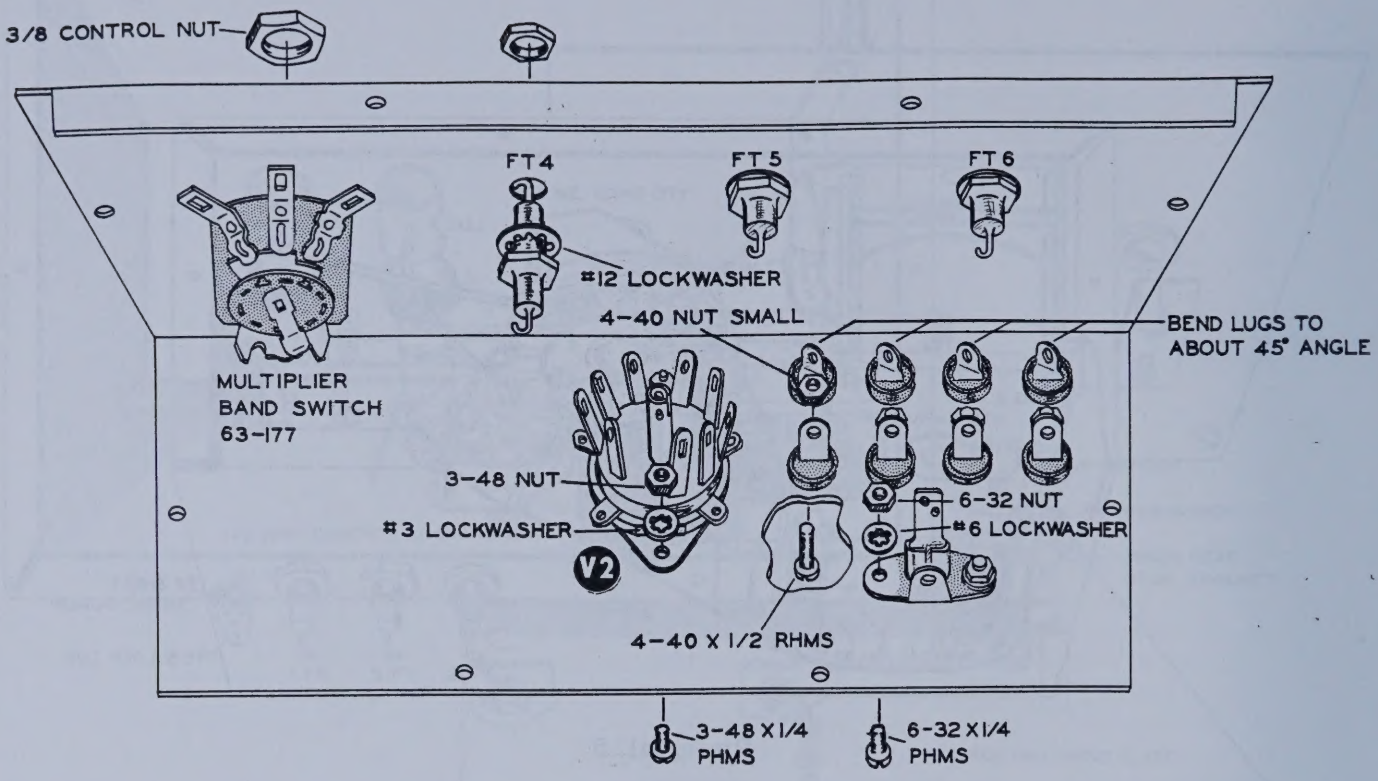
( ) Bend lug 2 of the VFO coil over to lug 10 on the band switch (S-3).

( ) Slip a 1/2" length of sleeving over the lead from lug 5 of the band switch and connect this lead to lug 2 of coil 6M (S-1).

( ) Cut a bare wire to 1 1/2" in length and connect one end to lug 7 on the band switch (S-1). Slip a 1 1/4" length of sleeving over the other end and connect this end to lug 2 of coil 2M (S-1).

This completes the wiring on the VFO subchassis. Check and make sure there are no wire clippings or solder blobs that could cause short circuits. Check the wiring over to make sure there are no leads touching and particularly around the tube socket; check for pins that may be touching.

Turn the rotors on both of the 20 mmf variable capacitors for minimum capacity (both plates unmeshed). Mark the edge of the screwdriver slot on the capacitors and also mark directly in line on the chassis with fingernail polish. This is to determine, for future reference, if the capacitors are fully meshed or open. Now lay the unit aside.


3/8 CONTROL NUT
FT4
FT5
FT6
#12 LOCKWASHER
4-40 NUT SMALL
BEND LUGS TO ABOUT 45° ANGLE
MULTIPLIER BAND SWITCH 63-177
3-48 NUT
#3 LOCKWASHER
V2
6-32 NUT
#6 LOCKWASHER
4-40 X 1/2 RHMS
3-48 X 1/4 PHMS
6-32 X 1/4 PHMS

Pictorial 6

MULTIPLIER SUBASSEMBLY

"L" Bracket

( ) Mount the 9-pin miniature ceramic socket along with the shield base, which mounts on top of the bracket, using 3-48 x 1/4" screws with #3 lockwashers under the nuts. Position the socket pins with the wide spacing, as shown in Pictorial 6.

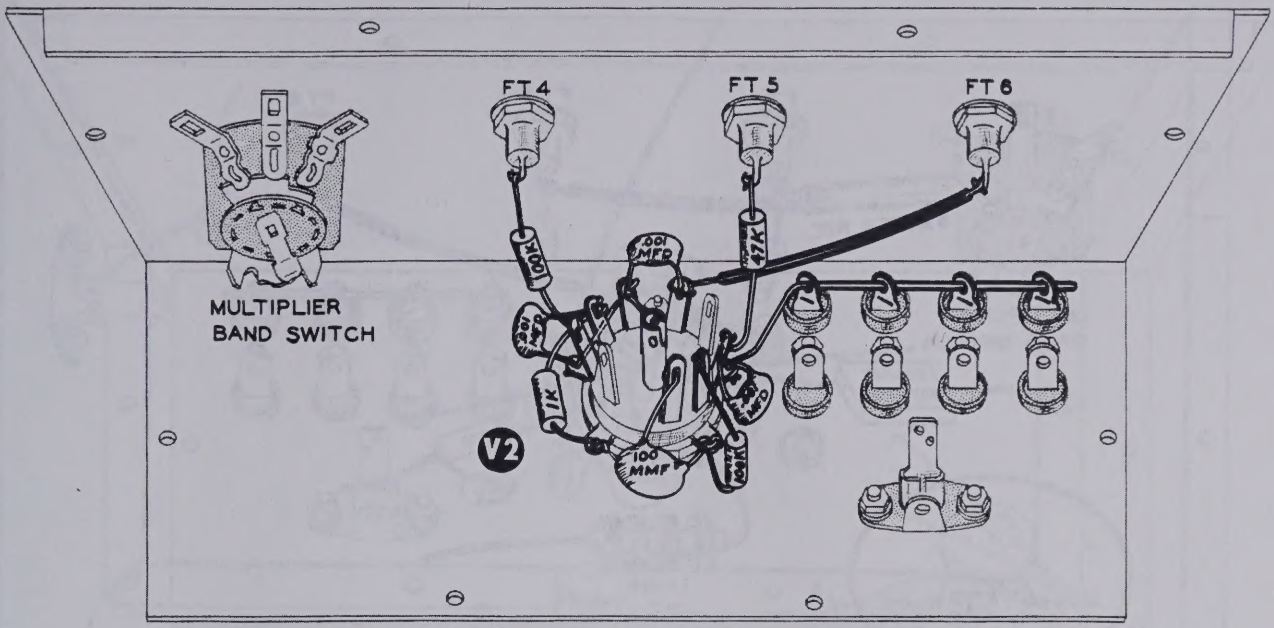
( ) Mount the four crystal sockets, using the 1/2" long 4-40 screws and the small 4-40 nuts. Allow the flat sides of the nuts to recess within the socket. Do not force the sockets or tighten the screws to extremes or the sockets may be broken.

( ) Mount the phono socket, using 6-32 x 1/4" screws with #6 lockwashers under the nuts. Face the ground lug as shown.

( ) Mount three of the .001 mfd feed-through capacitors at FT4, FT5, and FT6, using #12 lockwashers under the mounting flange of the capacitors. Position the hooks as shown.

( ) Mount the multiplier band switch (#63-177), using a 3/8" control lockwasher between the switch and bracket, and secure with a 3/8" control nut. Position the switch as shown.

( ) Bend the four crystal socket lugs that are near the bend in the bracket, to about a 45° angle. This will allow slipping a wire through the four lugs.



Pictorial 7

( ) Cut a bare wire to 2 1/2" in length. Slip the wire through the four crystal socket lugs bent to a 45° angle (S-4), and then connect to ground lug 3 of the tube socket (NS). See Pictorial 7.

( ) Feed a bare wire through the center post, then through pin 4, and then connect to ground lug 2 of tube socket V2. Solder the center post.

NOTE: All .001 mfd disc ceramic capacitors are 1 KV unless otherwise specified.

( ) Cut both leads of a .001 mfd disc ceramic capacitor to 5/16" in length. Connect one lead to pin 4 (S-2) and connect the other lead to pin 5 (NS) of V2.

( ) Cut both leads of a second .001 mfd disc ceramic capacitor to 5/16" in length. Connect one lead to ground lug 2 (S-2) and connect the other lead to pin 3 of V2 (NS).

( ) Cut both leads of a third .001 mfd disc ceramic capacitor to 5/16" in length. Connect one lead to ground lug 3 (S-2), and connect the other lead to pin 7 of V2 (NS).

( ) Cut a bare wire to 2 1/8" in length and connect one end to pin 5 of V2 (S-2). Slip a 1 1/2" length of sleeving over this lead and connect the other end to FT6 (S-1).

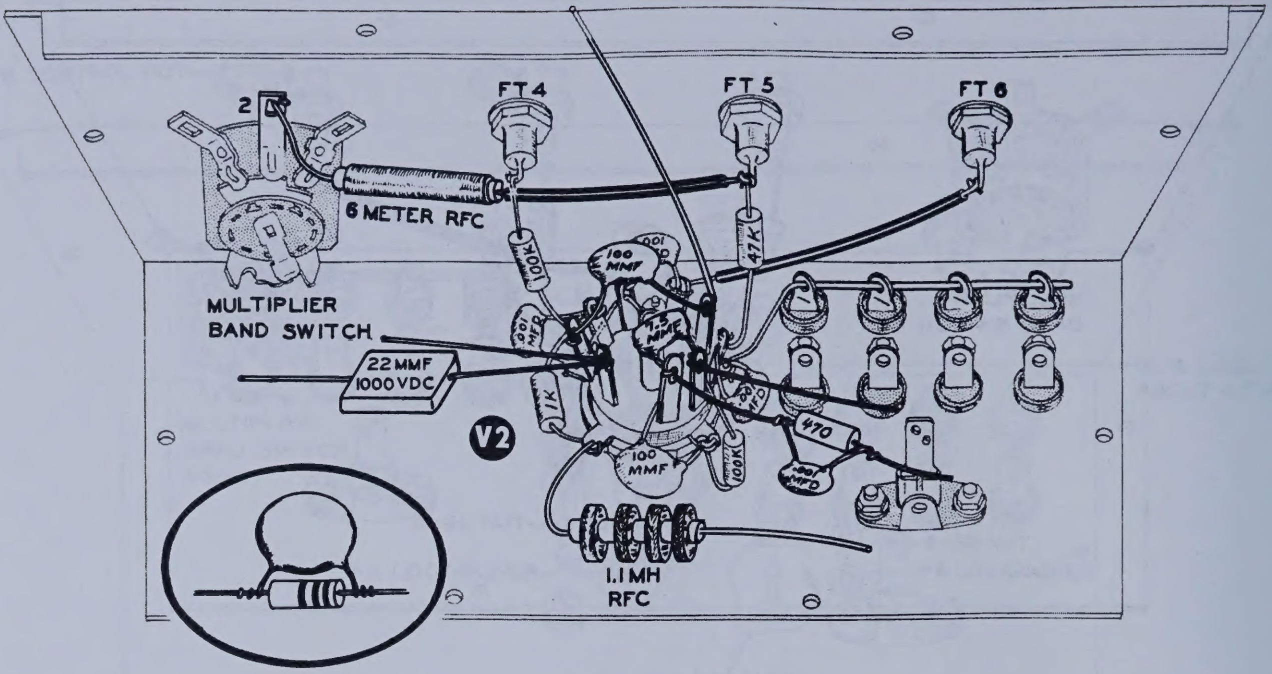
( ) Cut both leads of a 1 KΩ resistor (brown-black-red) to 5/8" in length. Connect one lead to pin 3 of V2 (S-2) and connect the other lead to ground lug 1 (NS).

( ) Cut both leads of a 100 KΩ resistor (brown-black-yellow) to 1/2" in length. Connect one end to FT4 (S-1) and connect the other end to pin 2 of V2 (NS).

( ) Cut both leads of a 47 KΩ resistor (yellow-violet-orange) to 3/8" in length. Connect one lead to pin 7 of V2 (S-2). Connect the other lead to FT5 (NS).

( ) Cut both leads of a 100 KΩ resistor (brown-black-yellow) to 1/2" in length. Connect one lead to ground lug 4 of V2 (NS). Connect the other lead to pin 8 (NS).

( ) Cut both leads of a 100 mmf disc ceramic capacitor to 3/8" in length. Connect one lead to ground lug 4 of V2 (S-2). Connect the other lead to pin 9 (NS).



Pictorial 8

( ) Cut one lead of a 100 mmf disc ceramic capacitor to 1/2" in length. Feed the long lead through pin 6 and connect the 1/2" lead to pin 2 of V2 (S-2). Mount the capacitor across the top of the tube socket, as shown. There should be 1 3/4" of lead extending past pin 6. Now solder pin 6. The other end of the lead from pin 6 will be connected later. See Pictorial 8.

( ) Cut both leads of the 7.5 mmf silver mica capacitor to 3/8" in length. Connect one lead to pin 8 of V2 (NS), and connect the other lead to pin 9 (NS). Mount the capacitor in the position as shown.

( ) Cut both leads of a 470 Ω resistor (yellow-violet-brown) to 3/4" in length. Now take a .001 mfd disc ceramic capacitor and cut both leads to 1/2" in length. Mount it across the 470 Ω resistor as shown in the insert on Pictorial 8. Solder both connections.

( ) Connect one lead of the 470 Ω resistor-.001 capacitor combination to pin 9 of V2 (S-3). The other end will be connected later.

( ) Cut a bare wire to 2" in length. Connect one end to pin 8 of V2 (S-3). The other end will be connected later.

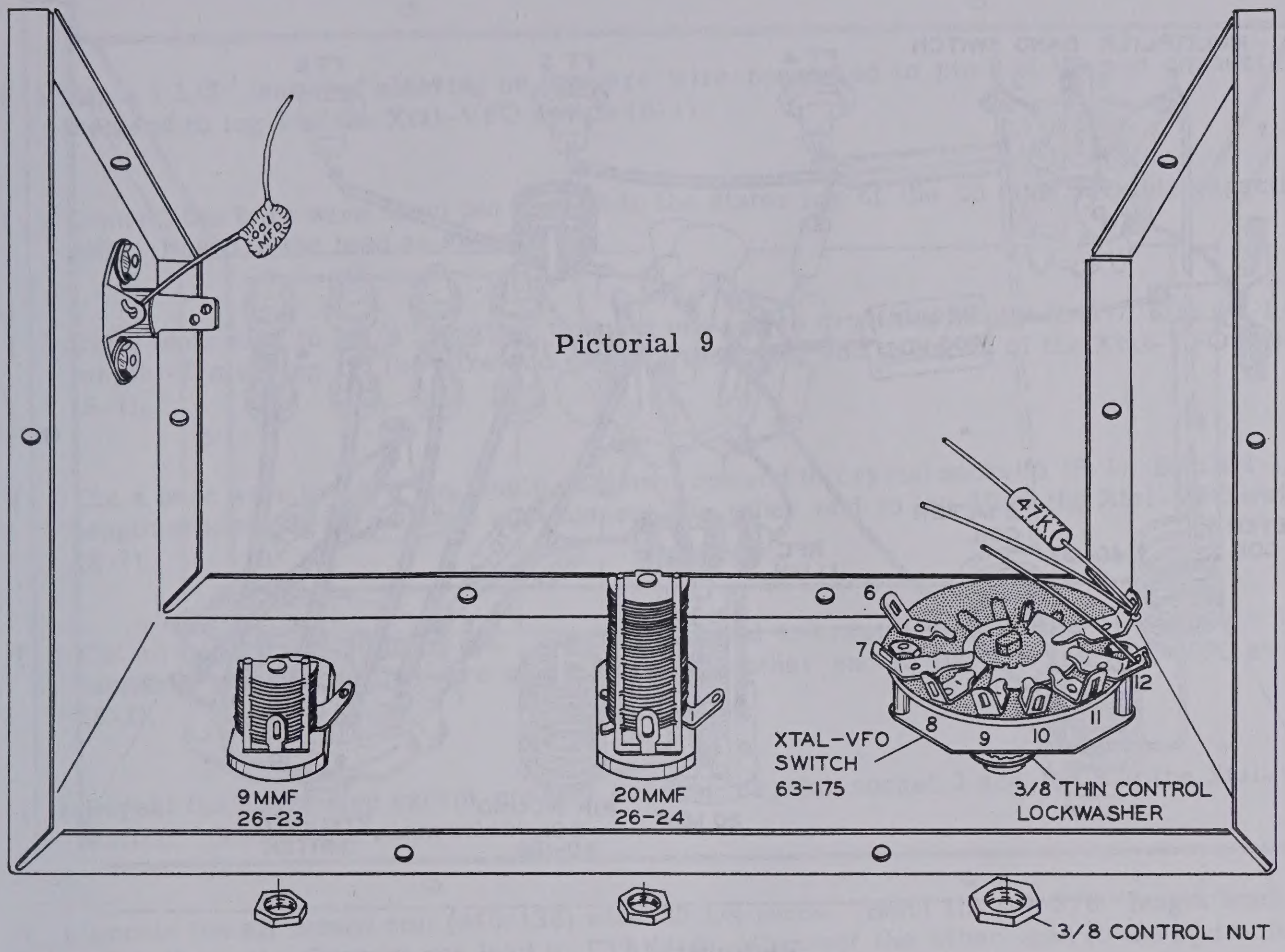
( ) Connect one lead of the 1.1 mh RF choke to ground lug 1 of V2 (S-2). The other lead will be connected later. Position the RF choke as shown.

( ) Cut one lead of a 6-meter RF choke (this is the single layer wound choke with the red dot marking) to 1" in length. Slip a 1 1/8" length of sleeving over the other lead. Connect the long lead with the sleeving to FT5 (NS). Connect the other lead to lug 2 of the band switch (NS). Position the RF choke as shown.

( ) Cut both leads of the 22 mmf 1000 VDC mica capacitor to 7/8" in length. Connect one lead to pin 1 of V2 (NS). The other lead will be connected later.

( ) Cut a bare wire to 2" in length. Connect one end to pin 1 of V2 (S-2). The other end will be connected later.

This finishes preliminary wiring of the "L" bracket.


Pictorial 9

MULTIPLIER SUBASSEMBLY

"U" Bracket

( ) Mount the phono socket, using 6-32 x 1/4" screws with #6 lockwashers under the nuts. Position the ground lug as shown in Pictorial 9.

( ) Mount the Xtal-VFO switch (#63-175) in the 25/64" hole, using a thin control lockwasher between the switch and bracket, and secure temporarily with a 3/8" control nut. Position the switch as shown.

( ) Mount the 20 mmf variable capacitor (#26-24) in the center hole, using the nut supplied with the capacitor, and secure temporarily. Locate and position as shown.

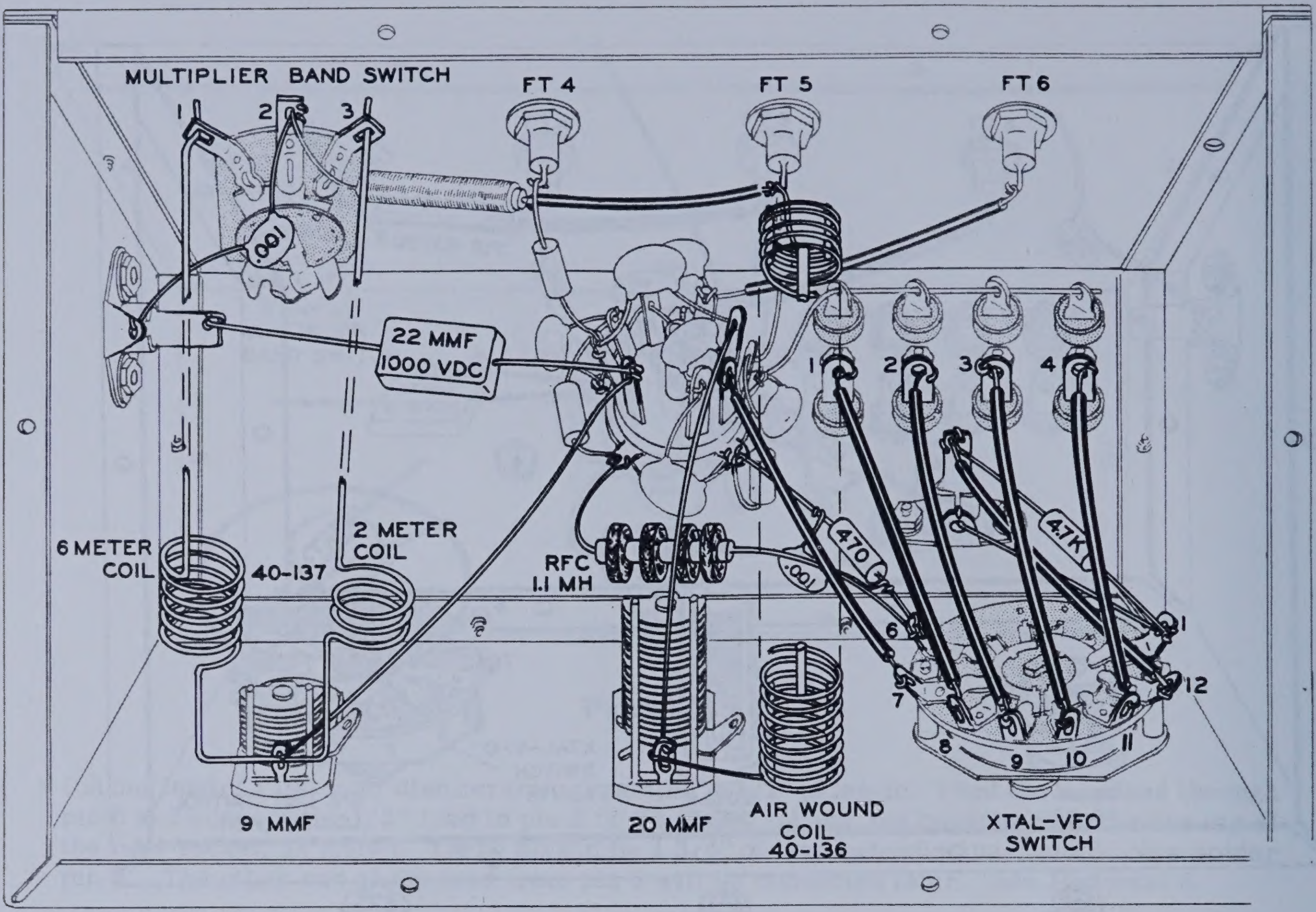
( ) In the same manner, mount the 9 mmf variable capacitor (#26-23) in the remaining hole.

( ) Cut both leads of a .001 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to the ground lug on the phono socket (S-1). The other end will be connected later.

( ) Cut both leads of a 47 KΩ (yellow-violet-orange) resistor to 5/8" in length. Connect one end to lug 1 of the Xtal-VFO switch (NS). The other end will be connected later.

( ) Cut a bare wire to 1 1/2" in length. Connect one end to lug 1 of the Xtal-VFO switch (S-2). The other end will be connected later.

( ) Cut a bare wire to 1 1/2" in length. Connect one end to lug 12 of the Xtal-VFO switch (S-1). The other end will be connected later.


MULTIPLIER BAND SWITCH
1
2
3
FT 4
FT 5
FT 6
.001
22 MMF
1000 VDC
1
2
3
4
6 METER
COIL
40-137
2 METER
COIL
RFC
1.1 MH
470
.001
4.7K
6
7
1
12
8
9
10
11
9 MMF
20 MMF
AIR WOUND
COIL
40-136
XTAL-VFO
SWITCH

Pictorial 10

( ) Now fasten the two brackets together as shown in Pictorial 10, using six #6 sheet metal screws. Observe that the phono socket on the "U" bracket is on the same end as the band switch on the "L" bracket. Mount a #6 solder lug under the sheet metal screw located near FT6.

( ) Connect the free lead of the .001 mfd disc ceramic capacitor from the ground lug of the phono socket on the "U" bracket to lug 2 of the band switch (S-2).

( ) Connect the free lead of the 22 mmf mica capacitor from pin 1 of V2 to the center lug of the phono socket on the "U" bracket (S-1).

( ) Connect the bare wire from pin 1 of V2 to the stator lug on the 9 mmf variable capacitor (NS).

( ) Connect the bare wire from lug 1 of the Xtal-VFO switch to the ground lug of the phono socket (S-1).

( ) Connect the free lead of the 47 KΩ resistor from lug 1 of the Xtal-VFO switch to the center lug of the phono socket on the "L" bracket (NS).

( ) Slip a 1 1/8" length of sleeving on the bare wire from lug 12 of the Xtal-VFO switch and connect the free end to the center conductor of the phono socket (S-2).

( ) Connect the free lead of the 1.1 mh RF choke to lug 6 of the Xtal-VFO switch (NS). Position the choke so there is clearance when the 20 mmf variable capacitor is opened.

( ) Connect the free lead of the 470 Ω resistor and .001 mfd capacitor combination to lug 6 of the Xtal-VFO switch (S-2).

( ) Slip a 1 1/2" length of sleeving on the bare wire connected to pin 8 of V2 and connect the free end to lug 7 of the Xtal-VFO switch (S-1).

( ) Connect the bare wire from pin 6 of V2 to the stator lug of the 20 mmf variable capacitor (NS). Position the lead as shown.

( ) Cut a bare wire to 1 3/4" length. Connect one end to crystal socket 4 (S-1). Slip a 1 1/4" length of sleeving on the wire and connect the other end to lug 11 of the Xtal-VFO switch (S-1).

( ) Cut a bare wire to 1 7/8" in length. Connect one end to crystal socket 3 (S-1). Slip a 1 1/2" length of sleeving on the wire and connect the other end to lug 10 of the Xtal-VFO switch (S-1).

( ) Cut a bare wire to 2" in length. Connect one end to crystal socket 2 (S-1). Slip a 1 5/8" length of sleeving on the wire and connect the other end to lug 9 of the Xtal-VFO switch (S-1).

( ) Repeat the above step except connect between crystal socket 1 and lug 8 of the Xtal-VFO switch. Solder both connections.

( ) Locate the air wound coil (#40-136) with 20 3/4 turns. Bend the two 3/8" length leads out from the coil. Connect one lead to FT5 (S-3). Connect the other lead to the stator lug of the 20 mmf variable capacitor (S-2). Position the coil as shown.

Before proceeding with the next two steps, study Pictorial 10 very carefully and observe the location and position of the multiplier plate coils (#40-137). Because of the wire size used in these coils, the connection to the stator lug on the 9 mmf variable capacitor is made by just laying the lead on the lug. Be sure to handle the coils with care. Do not squeeze or stretch the windings, for they have been preset at the factory.

( ) Connect the straight lead of the 6-meter coil (the coil with six turns) to lug 1 on the band switch (S-1).

( ) Connect the straight lead of the 2-meter coil (the coil with three turns) to lug 3 on the band switch (S-1). Place the other lead that is bent at right angles on the stator lug of the 9 mmf variable capacitor (S-2).

This completes the wiring of the multiplier subassembly. Check back through and make sure all leads have been soldered and that all connections check with the Pictorial. Check for possible short circuits, loose wire clippings and solder blobs. Lay the unit aside temporarily.

DRIVER MOUNTING BRACKET ASSEMBLY

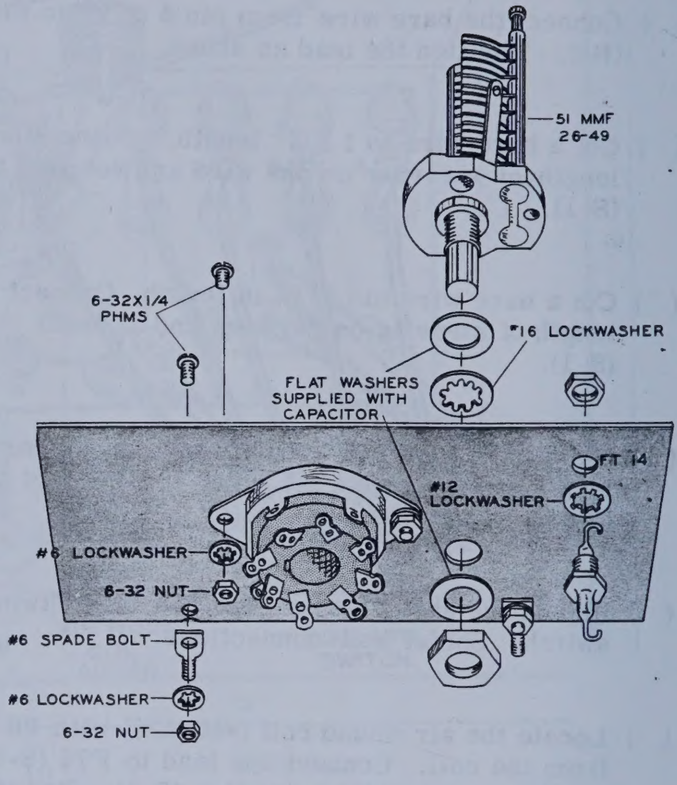
(✓) Locate the driver mounting bracket.

(✓) Mount a ceramic octal socket as shown in Detail 3, using 6-32 hardware. Be sure to position the keyway as shown.

(✓) Mount two spade bolts using 6-32 x 1/4" screws with #6 lockwashers under the nuts. Insert the 6-32 screws from the back side of the bracket, as shown.

(✓) Mount the 51 mmf variable capacitor (#26-49) from the back side of the bracket with the stator plates to the right side, as shown. Leave the flat metal washer on the threaded bushing, and secure with the nut and flat washer supplied.

(✓) Mount a .001 mfd feed-through capacitor in the remaining hole on the bracket, with a #12 lockwasher under the mounting flange of the capacitor. Position the hook as shown.

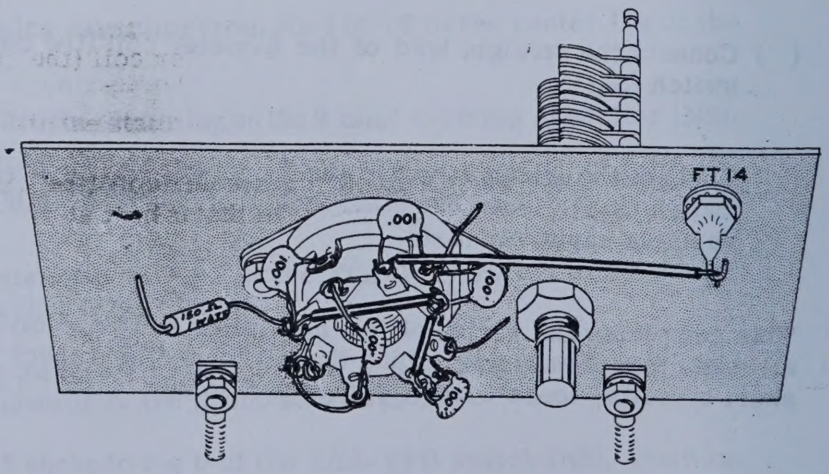

51 MMF
26-49
6-32X1/4
PHMS
#16 LOCKWASHER
FLAT WASHERS
SUPPLIED WITH
CAPACITOR
FT 14
#12
LOCKWASHER
#6 LOCKWASHER
6-32 NUT
#6 SPADE BOLT
#6 LOCKWASHER
6-32 NUT

Detail 3

(✓) Cut one lead of a .001 mfd disc ceramic capacitor to 1/2" in length and the other lead to 1" in length. Feed the 1" length lead through pin 7 (S-1) of the octal tube socket V3, and then to ground lug 4 (NS). Connect the other lead to pin 2 (NS). See Detail 4.

(✓) Cut a bare wire to 5/8" in length and connect one end to pin 8 (S-1). Connect the other end to ground lug 4 (S-2).

(✓) Cut a bare wire to 1 7/8" in length and feed the wire through pin 1 (NS). Slip a 7/8" length of sleeving over the lead and feed through pin 4 (NS). Slip a 1/2" length of sleeving over this lead and connect to pin 6 (NS).


FT 14
.001
.001
.001
.001

Detail 4

( ) Cut both leads of a .001 mfd disc ceramic capacitor to 3/8" in length and connect one lead to pin 6 (S-2). Connect the other lead to ground lug 3 (S-1).

( ) Cut both leads of a .001 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to pin 4 (S-3). Connect the other lead to ground lug 2 (NS).

( ) Cut both leads of a .001 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to pin 1 (NS). Connect the other lead to ground lug 1 (S-1).

( ) Cut both leads of a .001 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to pin 3 (NS). Connect the other lead to ground lug 2 (NS).

( ) Connect a 3/4" length of bare wire to pin 5 (S-1). Position the wire as shown. The other end will be connected later.

( ) Connect a 1" length of bare wire to ground lug 2 (S-3). The other end will be connected later.

( ) Cut a bare wire to 2 1/4" in length. Connect one end to pin 3 (S-2). Slip a 1 7/8" length of sleeving over the lead and connect the other end to the feed-through capacitor (S-1).

( ) Cut both leads of a 150 Ω 1 watt resistor (brown-green-brown) to 1/2" in length. Connect one end to pin 1 (S-3). The other end will be connected later.

This completes preliminary wiring of the driver bracket. Lay the unit aside temporarily.

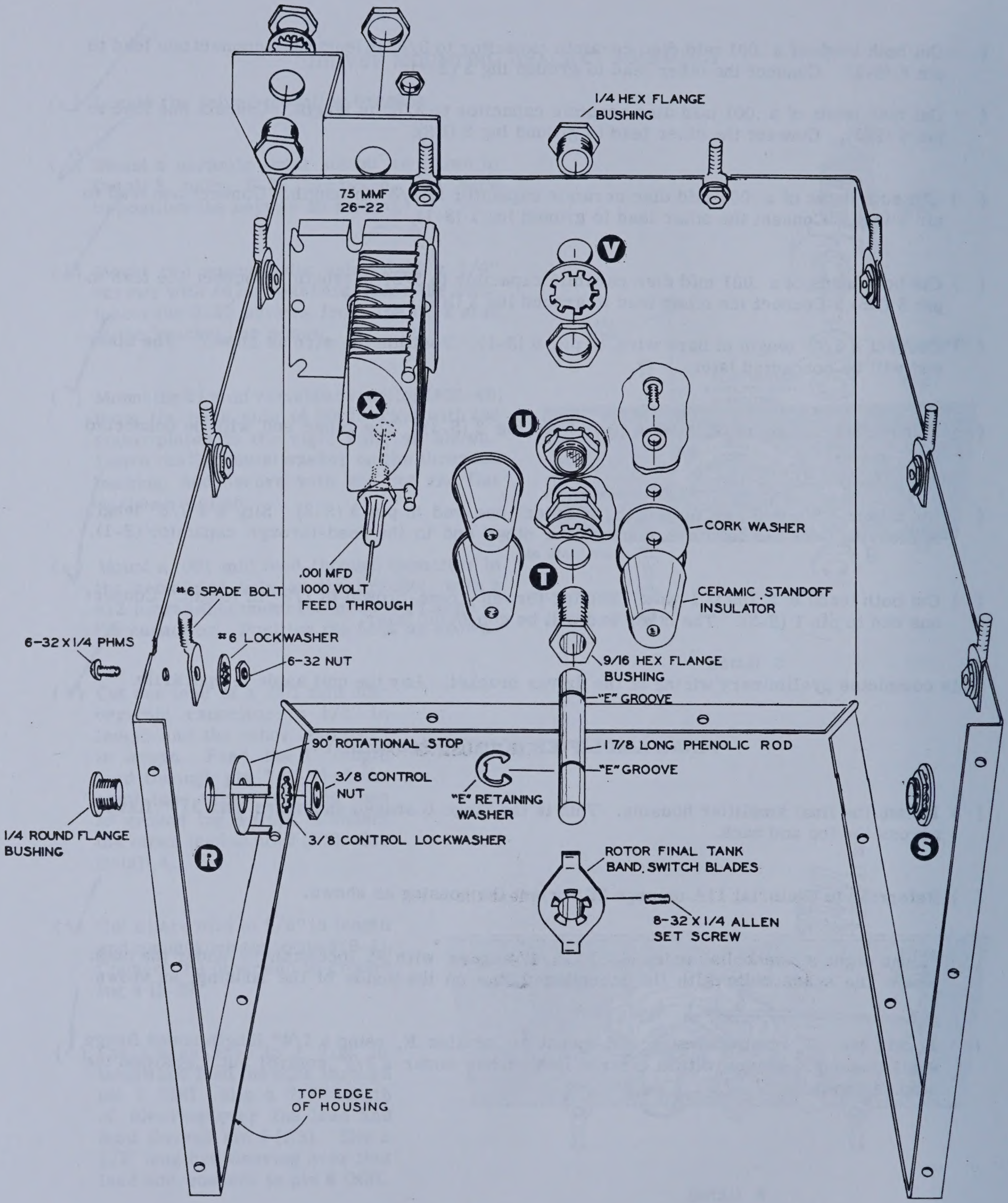
FINAL AMPLIFIER HOUSING ASSEMBLY

( ) Locate the final amplifier housing. This is the large U shaped enclosure with 3/8" flanges across the top and back.

( ) Referring to Pictorial 11A on page 26, orient the housing as shown.

( ) Mount eight spade bolts, using 6-32 x 1/4" screws with #6 lockwashers under the nuts. Mount the spade bolts with the mounting flange on the inside of the housing, as shown.

( ) Locate the 90° rotational stop and mount at location R, using a 1/4" length round flange shaft bushing. Secure with a control lockwasher under a 3/8" control nut. Position the stop as shown.


1/4 HEX FLANGE
BUSHING
75 MMF
26-22
V
X
U
CORK WASHER
T
CERAMIC STANDOFF
INSULATOR
.001 MFD
1000 VOLT
FEED THROUGH
#6 SPADE BOLT
#6 LOCKWASHER
6-32 X 1/4 PHMS
6-32 NUT
9/16 HEX FLANGE
BUSHING
"E" GROOVE
90° ROTATIONAL STOP
1 7/8 LONG PHENOLIC ROD
"E" GROOVE
3/8 CONTROL
NUT
"E" RETAINING
WASHER
1/4 ROUND FLANGE
BUSHING
3/8 CONTROL LOCKWASHER
R
S
ROTOR FINAL TANK
BAND SWITCH BLADES
8-32 X 1/4 ALLEN
SET SCREW
TOP EDGE
OF HOUSING

Pictorial 11A

(✓) Mount a second 1/4" length round flange shaft bushing at location S.

(✓) Mount two 1/4" length hex flange shaft bushings at locations U and V.

(✓) Mount a 9/16" length shaft bushing at location T. Insert the bushing through the hole from the inside of the housing, as shown, securing with a control lockwasher and nut.

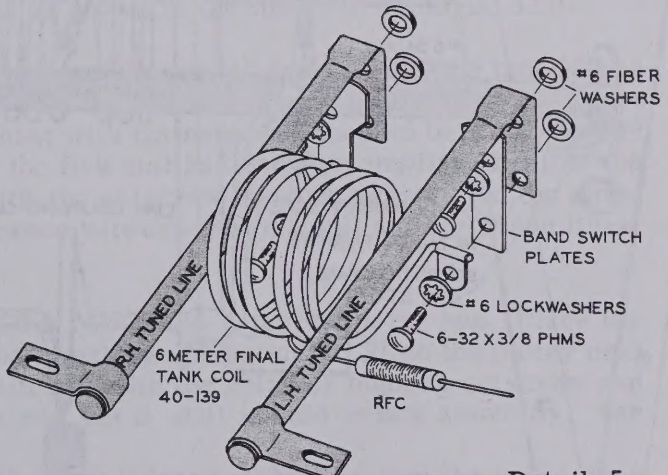
(✓) Mount the four ceramic standoff insulators on the inside of the housing, using the hardware already mounted on the units. Mount the units with the cork washer between the insulators and the housing, as shown. Remove the short 6-32 screws from the other end and discard them. Save the four flat washers for they will be used later.

(✓) Locate the antenna coupling dial cord bracket. This is the bracket with four plastic pulleys assembled to it. Mount a 1/4" length hex flange shaft bushing in the 25/64" hole that is located on the same flange with two plastic pulleys. Insert from the side, as shown, and secure with a 3/8" lockwasher and nut.

(✓) Locate the 75 mmf variable loading capacitor (#26-22) and mount as shown, along with the antenna coupling dial cord bracket. Place a 3/8" control lockwasher on the capacitor, insert into the hole from inside of the housing, place the bracket in position on the outside of the housing as shown, and secure with a control nut.

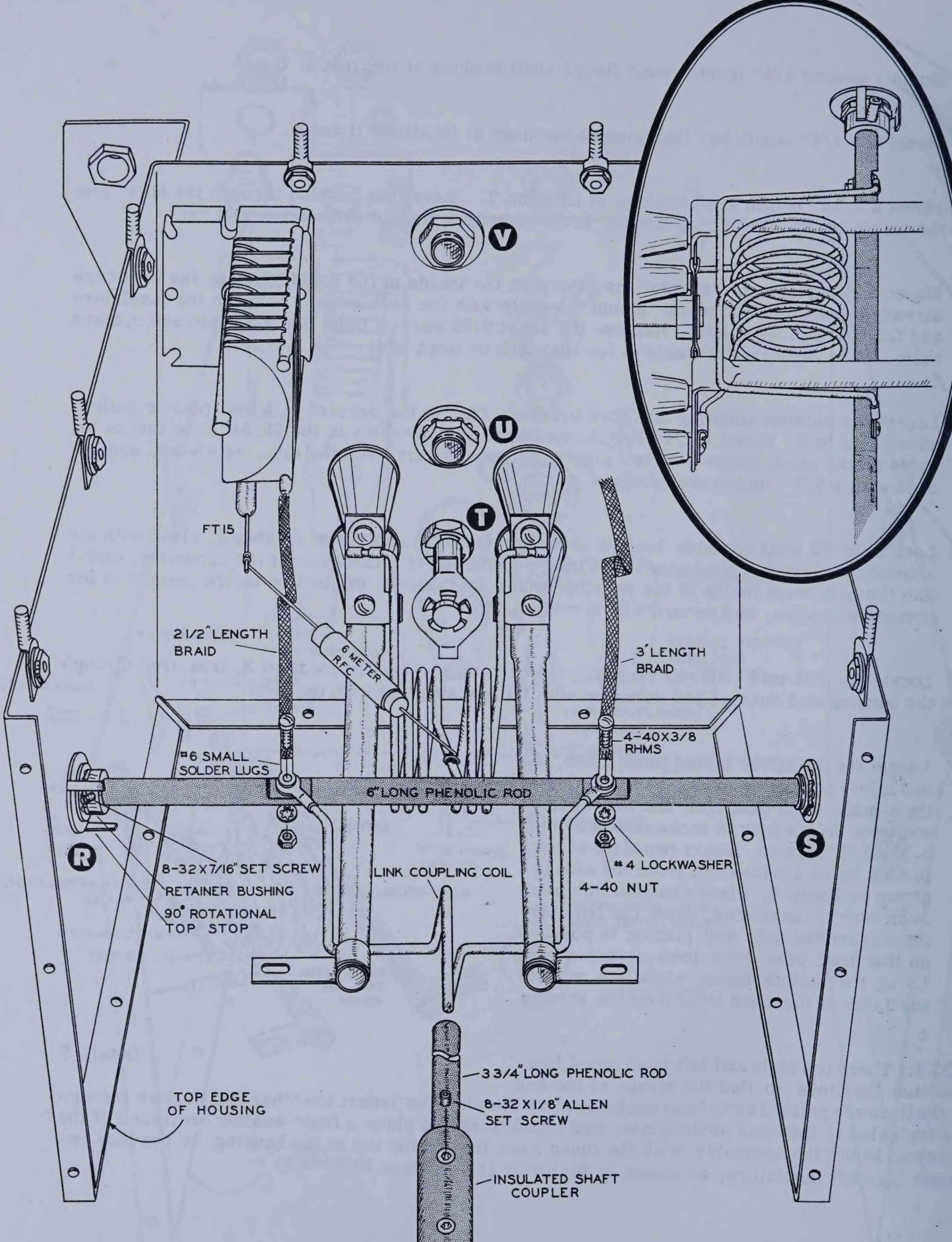
( ) Locate the .001 mfd 1000 volt feed-through capacitor. Mount at location X, inserting through the housing and bracket and securing with the nut supplied with the unit.

( ) Locate the two silver plated tuned lines, the two silver plated "fixed" band switch plates, the 6-meter final tank coil, and four #6 fiber washers. Place four #6 lockwashers on four 6-32 x 3/8" screws. Insert two of the screws in each lug on the tank coil from the side, as shown in Detail 5. Place a band switch plate over each of the screws, using the hole farthest from the tab, and placing in position so that both tabs point toward each other. Using the bottom holes, place the mounting flange of the tuned lines over the screws.



Detail 5

NOTE: There is a right and left hand tuned line. Position the lines so that the straps at the end of the lines are pointed away from each other, as shown. Now insert the other two screws through the top holes of the band switch plates and tuned lines and place a fiber washer over each of the screws. Mount the assembly, with the tuned lines toward the top of the housing, to the four ceramic standoff insulators, as shown in Pictorial 11B on Page 28.


V
U
T
FT15
2 1/2" LENGTH BRAID
6 METER RFC
3' LENGTH BRAID
4-40 X 3/8 RHMS
#6 SMALL SOLDER LUGS
6" LONG PHENOLIC ROD
R
S
8-32 X 7/16" SET SCREW
RETAINER BUSHING
90° ROTATIONAL TOP STOP
LINK COUPLING COIL
#4 LOCKWASHER
4-40 NUT
3 3/4" LONG PHENOLIC ROD
8-32 X 1/8" ALLEN SET SCREW
TOP EDGE OF HOUSING
INSULATED SHAFT COUPLER

Pictorial 11B

(✓) Locate the final band switch rotor blades. Start an 8-32 x 1/4" Allen setscrew in the bushing. Slip the band switch blades over the fixed band switch plate tabs with the setscrew towards the top of the housing.

(✓) Locate the 1 7/8" long phenolic rod with the two E washer grooves. Notice that one E groove is farther from the end of the rod than the other. Insert this end, from the outside, into the 9/16" length shaft bushing at location T and into the rotor band switch bushing. Insert E washers in the two grooves on each side of the 9/16" shaft bushing. Now tighten the Allen setscrew in the band switch bushing. Rotate the switch a few times to make sure the blades engage the tabs each time. See both Pictorials 11A and 11B.

(✓) Position the 6-meter RF choke from the final tank coil, as shown, and connect the lead to the feed-through capacitor FT15 (S-1). Clip off the excess lead length.

(✓) Locate the 3 3/4" long phenolic rod and insert one end into the insulated shaft coupler. Secure with an 8-32 x 1/8" Allen setscrew. Start a second 8-32 x 1/8" Allen setscrew in the other tapped hole. Now insert the shaft assembly in the shaft bushing at location U from inside the housing.

(✓) Locate the link coupling coil and the 6" long phenolic rod with the two holes. Notice also in this rod that one of the holes is farther from the end of the rod than the other. Insert this end in the shaft bushing at location S and across the housing toward hole R.

(✓) Place the retainer bushing on the shaft and then pass the rod on through the shaft bushing at location R.

(✓) Place a #6 small solder lug on each of two 4-40 x 3/8" screws. Insert the screws in the two holes in the rod from the flat side, placing a #4 lockwasher and starting a 4-40 nut on each screw.

(✓) Slip the lugs on the link coupling coil behind the #6 small solder lugs just mounted on the rod, and tighten the screws. Position the link coil as shown in the insert in Pictorial 11B.

(✓) Position the rod so that the link coupling coil is evenly spaced on each side of the tuned lines and the one-turn loop is centered in the wide spacing of the 6-meter final tank coil. Start an 8-32 x 7/16" setscrew in the retainer bushing with the setscrew located between the 90° arc of the rotational stop. When centering of the link coil has been accomplished, slide the retainer bushing next to the shaft bushing with the setscrew resting against the top stop. Rotate the rod until there is about 1/16" clearance between the link coil and the tuned lines. Tighten the setscrew.

(✓) Locate the 2 1/2" dial pulley and start an 8-32 x 1/4" Allen setscrew in the hub. Place the pulley on the rod which protrudes from the shaft bushing at location R. Slide the pulley next to the shaft bushing, positioning the setscrew in line with the retainer bushing setscrew and tighten. There should be no sideplay on the rod but it still should rotate smoothly. See Detail 6 on page 30.

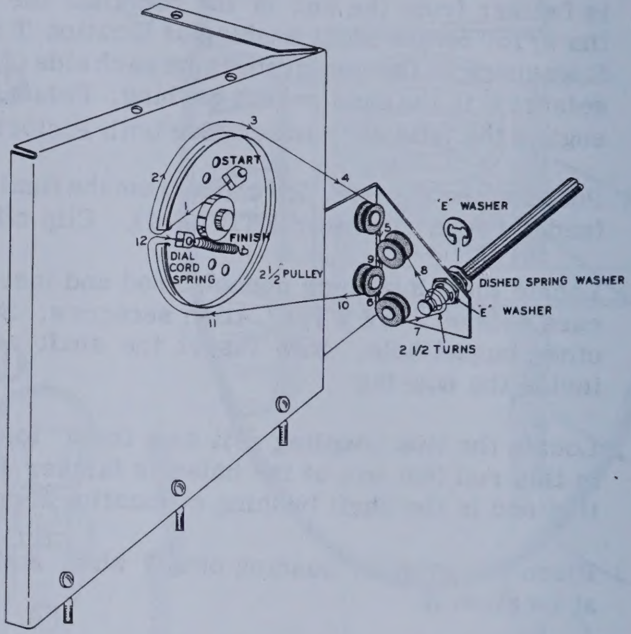
(✓) Rotate the link coupling coil a few times. Make sure it does not short against the tuned lines or the final tank coil. It may be necessary to shift the final tank coil into position so that the link coupling coil couples completely into it without shorting. If it is necessary to move the final tank coil, avoid changing the turns spacing or the overall dimensions. Proper spacing of the link coupling coil should appear as shown in the insert on Pictorial 11B.

(✓) Cut a length of flat braid to 2 1/2". Use a pointed instrument to open the braid at each end. Slip the braid over the round stator lug on the 75 mmf variable loading capacitor and solder. Avoid using too much solder.

(✓) Slip the other end of the braid over the #6 small solder lug mounted on the phenolic rod and solder.

(✓) Cut a second piece of braid to a length of 3". Open the ends of the braid as before and connect one end to the other #6 small solder lug, as shown, and solder. The other end will be connected later.

(✓) Locate the 3 1/8" length steel shaft with two E grooves and a dial cord groove located near one end of the shaft. Slip an E washer into the groove near the dial cord groove. Insert the shaft in the bushing on the antenna coupling dial cord bracket from the same side the plastic pulleys are mounted. See Detail 6. Place a dished spring brass washer over the other end of the shaft and slide next to the shaft bushing past the E groove. Slip an E washer in the other E groove.



Detail 6

(✓) Locate a dial cord spring and, using a pair of long-nose pliers, open the hooks on each end slightly. Locate the 20 1/2" length of dial cord. Place the eyelet over the hook on the antenna coupling pulley marked "Start". Following the consecutively numbered arrows, feed the cord through the rim opening, over the top of the pulley, and over to the top plastic pulley. Then feed the cord down to the bottom plastic pulley, over to the dial cord groove on the shaft making 2 1/2 turns around the shaft, then up to the second plastic pulley from the top, back down to the second plastic pulley from the bottom and then over to the antenna coupling pulley, around the bottom and back through the rim opening. Now hook one end of the spring on the eyelet and hook the other end on the pulley marked "Finish".

(✓) Rotate the shaft a few times to make sure it works properly. Rotating the shaft in a clockwise direction should couple the link into the 6-meter final tank coil.

This completes assembly of the final amplifier housing.

MOUNTING PARTS ON MAIN CHASSIS

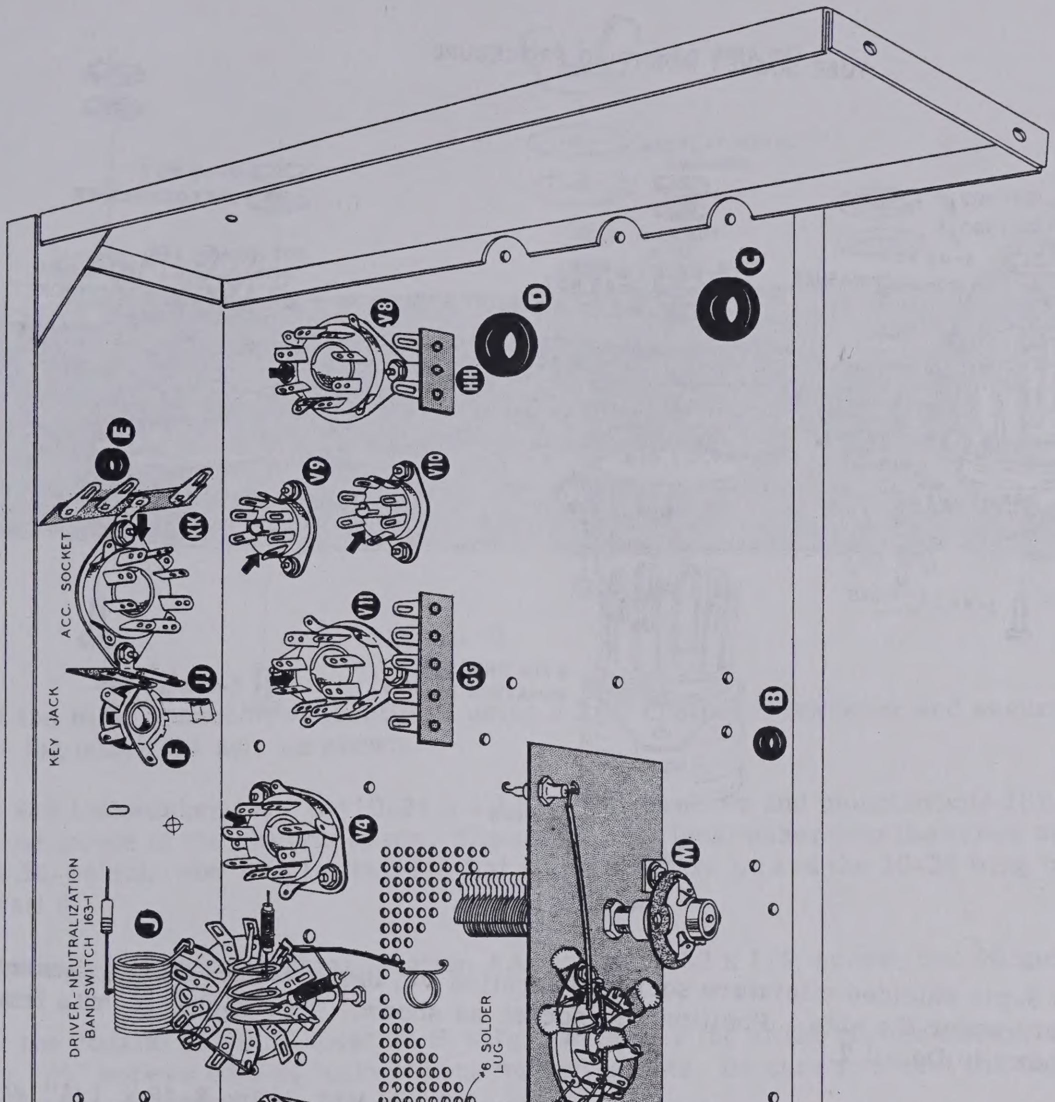
(✓) Insert a 1/2" rubber grommet in hole A. See Pictorial 12.

(✓) Insert a 5/16" rubber grommet in hole B.

(✓) Insert 3/4" rubber grommets in holes C and D.

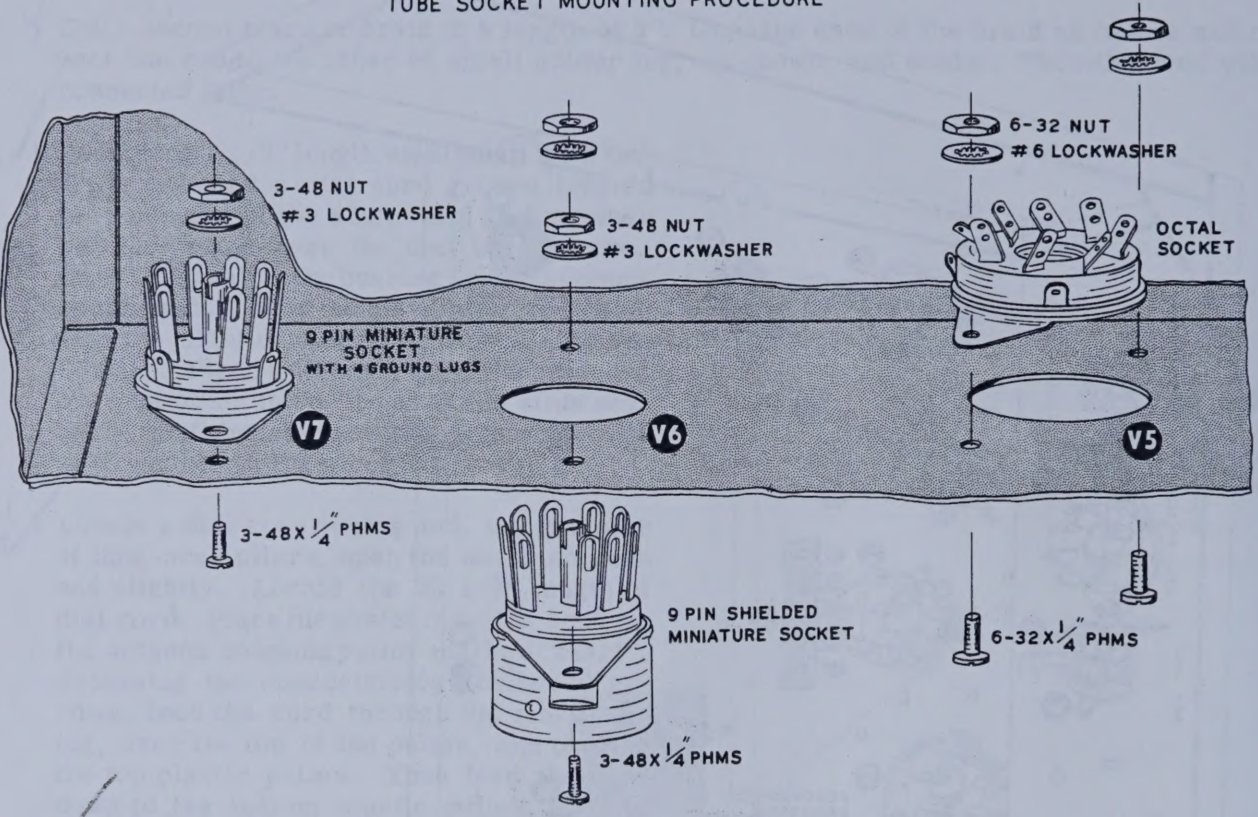
(✓) Insert a 3/8" rubber grommet in hole E.

(✓) Mount a 9-pin miniature socket with the four ground lugs at location V7 and position the socket so that the wide pin spacing is as shown. Use 3-48 x 1/4" screws with #3 lockwashers under the nuts.


KEY JACK
ACC. SOCKET
DRIVER-NEUTRALIZATION BANDSWITCH 163-1
MIKE CONNECTOR
#6 SOLDER LUG
A
B
D
E
F
G
H
J
K
L
M
AA
DD
GG
HH
JJ
KK
V3
V4
V5
V6
V7
V8
V9
V10
V11

Pictorial 12

TUBE SOCKET MOUNTING PROCEDURE



3-48 NUT
# 3 LOCKWASHER
9 PIN MINIATURE SOCKET WITH 4 GROUND LUGS
V7
3-48 NUT
# 3 LOCKWASHER
V6
6-32 NUT
# 6 LOCKWASHER
OCTAL SOCKET
V5
3-48 X 1/4" PHMS
9 PIN SHIELDED MINIATURE SOCKET
3-48 X 1/4" PHMS
6-32 X 1/4" PHMS

Detail 7

(✓) Mount the 9-pin shielded miniature socket at location V6, using 3-48 x 1/4" screws with #3 lockwashers under the nuts. Position the socket as shown. This socket mounts from the top, as shown in Detail 7.

(✓) Mount the two 7-pin miniature sockets at locations V9 and V10, using 3-48 x 1/4" screws with #3 lockwashers under the nuts. Position the sockets as shown.

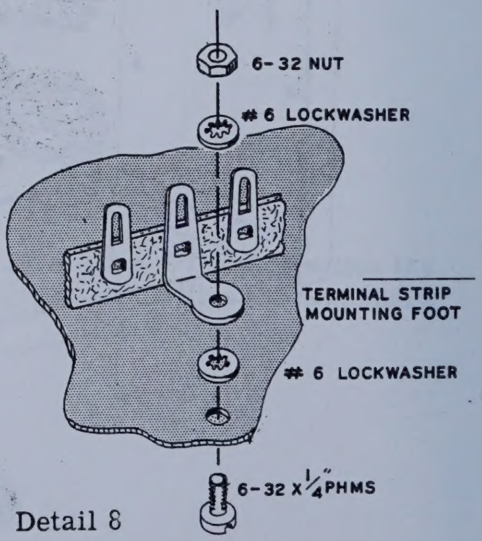
(✓) Mount the two ceramic octal sockets at locations V4 and V5, using 6-32 x 1/4" screws with #6 lockwashers under the nuts. Position the two sockets so that the keyways are facing away from each other, as shown in Pictorial 12.

(✓) Mount a mica octal socket at the accessory location with a 3-lug terminal strip KK and a 2-lug terminal strip JJ positioned as shown. Use 6-32 x 1/4" screws with #6 lockwashers under the foot of the terminal strips and under the nuts. Refer to Detail 8 for mounting of terminal strips. Position the keyway of the socket as shown.

(✓) Mount two of the mica octal sockets at locations V8 and V11, using 6-32 x 1/4" screws with #6 lockwashers under the nuts. Mount a 5-lug terminal strip GG with the mica octal socket at location V11 and a 2-lug terminal strip HH at location V8, as shown.

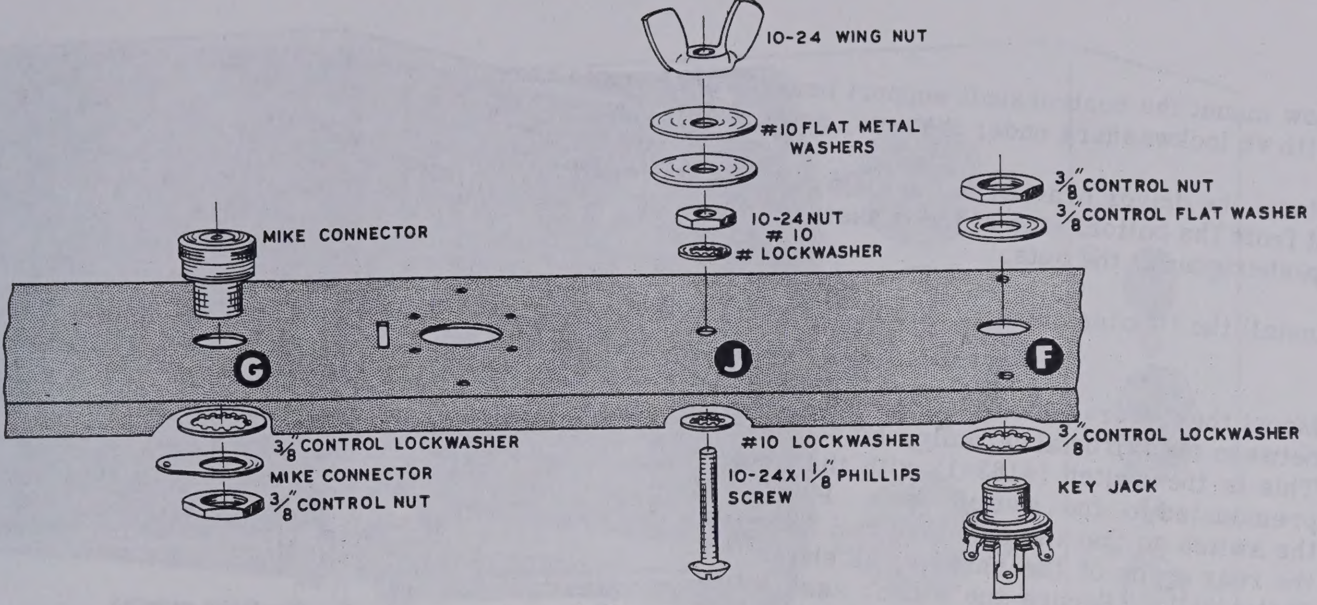
(✓) Slip a 3/8" control lockwasher over the key jack and mount at location F, using a 3/8" control nut with a 3/8" control flat washer under the nut, as shown in Detail 9. Position the key jack as shown.

TERMINAL STRIP MOUNTING PROCEDURE



6-32 NUT
# 6 LOCKWASHER
TERMINAL STRIP MOUNTING FOOT
# 6 LOCKWASHER
6-32 X 1/4" PHMS

Detail 8


10-24 WING NUT
#10 FLAT METAL WASHERS
3/8" CONTROL NUT
3/8" CONTROL FLAT WASHER
MIKE CONNECTOR
10-24 NUT
#10 LOCKWASHER
G
J
F
3/8" CONTROL LOCKWASHER
MIKE CONNECTOR
3/8" CONTROL NUT
#10 LOCKWASHER
10-24 X 1 1/8" PHILLIPS SCREW
3/8" CONTROL LOCKWASHER
KEY JACK

Detail 9

(✓) Mount the mike connector at location G using a 3/8" control lockwasher and secure with the solder lug under the nut, as shown.

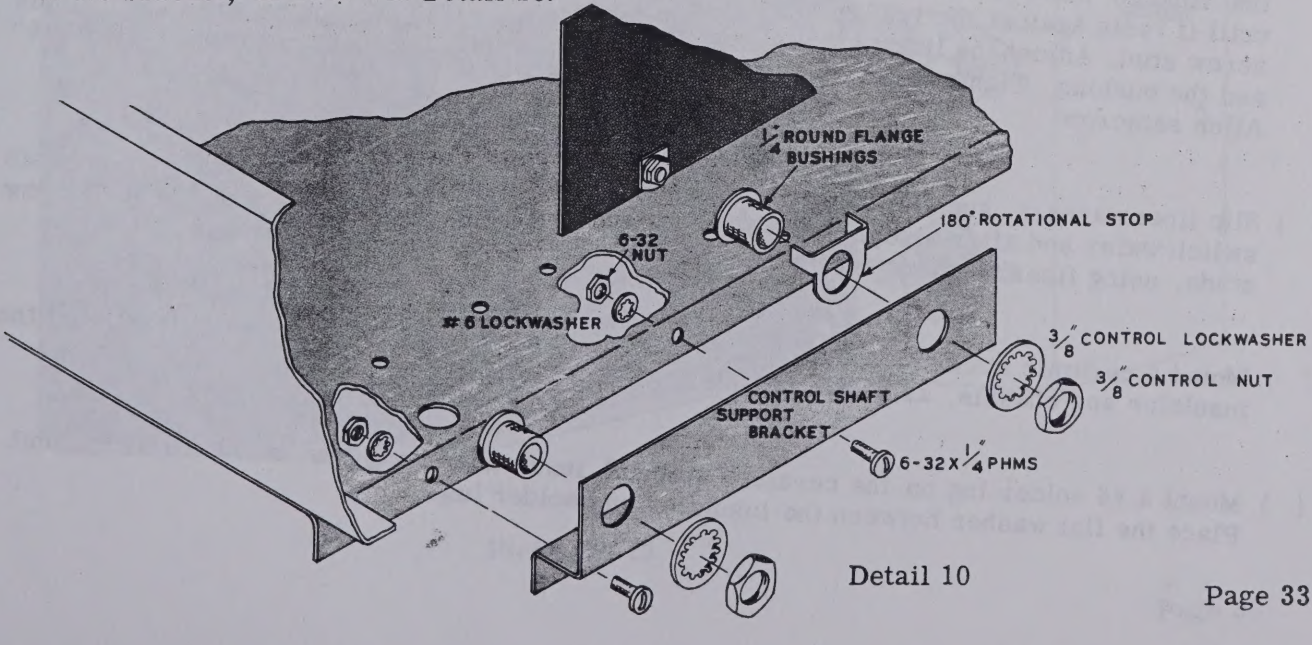
(✓) Slip a #10 lockwasher over the 10-24 x 1 1/8" Phillips screw and mount in hole J by inserting from the inside of the chassis apron. Slip another #10 lockwasher over the screw and secure with a 10-24 nut. Now slip the two #10 flat metal washers on and the 10-24 wing nut. Refer to Detail 9.

(✓) Mount a 5-lug terminal strip at location AA, using a 6-32 x 1/4" screw, two #6 lockwashers and nut.

(✓) Mount the coaxial shield at location H with a #6 solder lug at the corner shown, using four 4-40 x 1/4" screws with #4 lockwashers under the nuts. Be sure to mount the shield below the chassis, as shown.

(✓) Mount the relay at location K, using a 6-32 x 3/8" screw with a #6 lockwasher under the head of the screw. Position the relay as shown.

(✓) Locate the control shaft support bracket and mount two 1/4" round flange bushings in the 25/64" holes. Mount the 180° rotational stop along with the bushing on the right hand side of the bracket, as shown in Detail 10.


1/4" ROUND FLANGE BUSHINGS
180° ROTATIONAL STOP
6-32 NUT
#6 LOCKWASHER
3/8" CONTROL LOCKWASHER
3/8" CONTROL NUT
CONTROL SHAFT SUPPORT BRACKET
6-32 X 1/4 PHMS

Detail 10

(✓) Now mount the control shaft support bracket to the main chassis, using 6-32 x 1/4" screws with #6 lockwashers under the nuts, as shown in Pictorial 12.

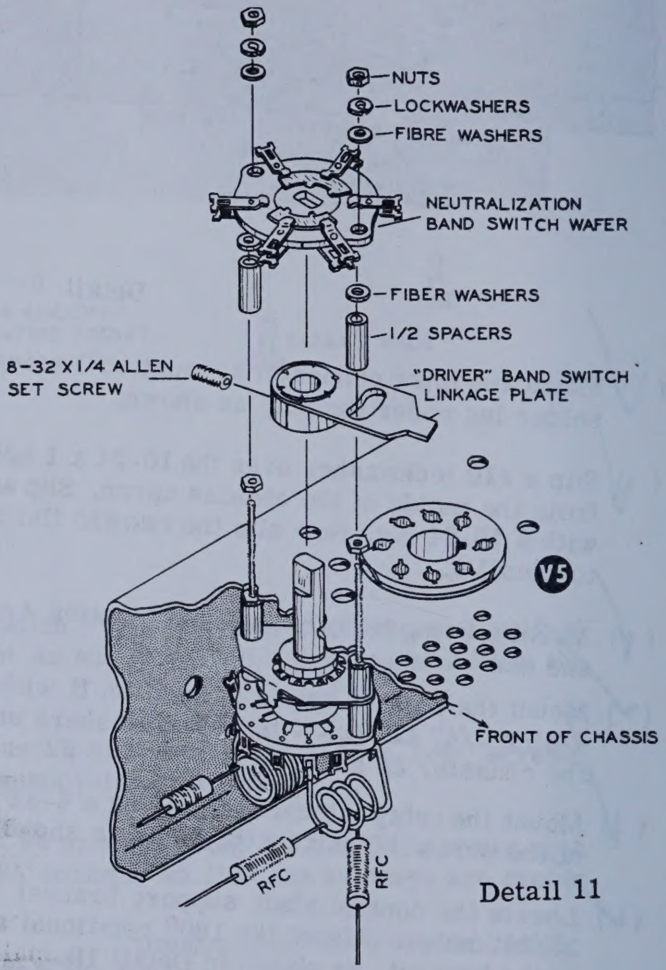
(✓) Mount the driver bracket to the main chassis by inserting the spade bolts into holes L and M from the bottom side of the chassis. Secure the bracket, using #6-32 nuts with #6 lockwashers under the nuts.

(✓) Install the flexible coupling on the 51 mmf capacitor shaft and tighten the two setscrews.

(✓) Mount the driver-neutralization band switch between the two octal ceramic tube sockets. This is the switch (#163-1) with the coils premounted to the switch deck. Position the switch so that the insulated coil is near the rear apron of the chassis, as shown in Pictorial 12. Secure the switch assembly from the top side of the chassis with the two nuts supplied with the switch. See Detail 11. Do not overtighten or damage to the ceramic wafer may result.

( ) Leave the main chassis top side up for the following assemblies.

( ) Study Detail 11 and Pictorial 13. Observe how the band switch linkage plate is mounted. Slip the two 1/2" spacers supplied with the band switch over the two protruding screw studs. Align the flats on the band switch control shaft with the screw studs. Slip the "driver" band switch linkage plate on the control shaft with the bushing towards the chassis. Align the slot in the linkage plate so that it slips over the protruding screw stud near the front of the chassis. Swing the linkage plate toward tube socket V5 until it rests against the 1/2" spacer on the screw stud. Adjust the linkage plate until there is about 1/16" spacing between the chassis and the bushing. Tighten the linkage plate to the switch control shaft, using an 8-32 x 1/4" Allen setscrew.

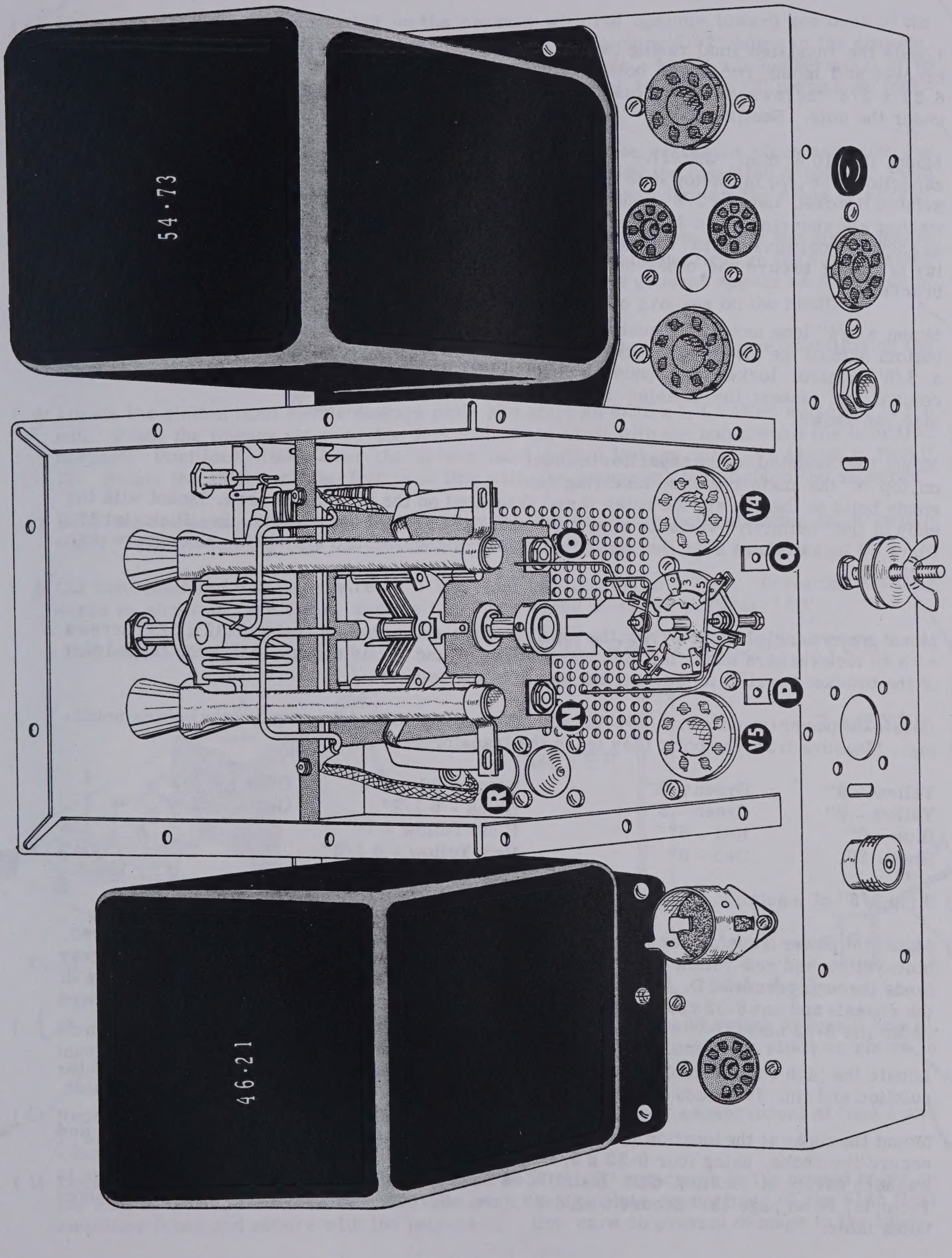

NUTS
LOCKWASHERS
FIBRE WASHERS
NEUTRALIZATION BAND SWITCH WAFER
FIBER WASHERS
1/2 SPACERS
8-32 X 1/4 ALLEN SET SCREW
"DRIVER" BAND SWITCH LINKAGE PLATE
V5
FRONT OF CHASSIS
RFC
RFC

Detail 11

( ) Slip fiber washers, supplied with the switch, over each of the screw studs. Take the ceramic switch wafer and after studying Detail 11 for proper positioning, mount it on the two screw studs, using fiber washers and lockwashers under the nuts. Do not overtighten.

( ) Mount a ceramic standoff insulator at location R. Mount with the cork washer between the insulator and chassis, as shown in Pictorial 13.

( ) Mount a #6 solder lug on the ceramic standoff insulator, using the hardware on the unit. Place the flat washer between the insulator and solder lug.

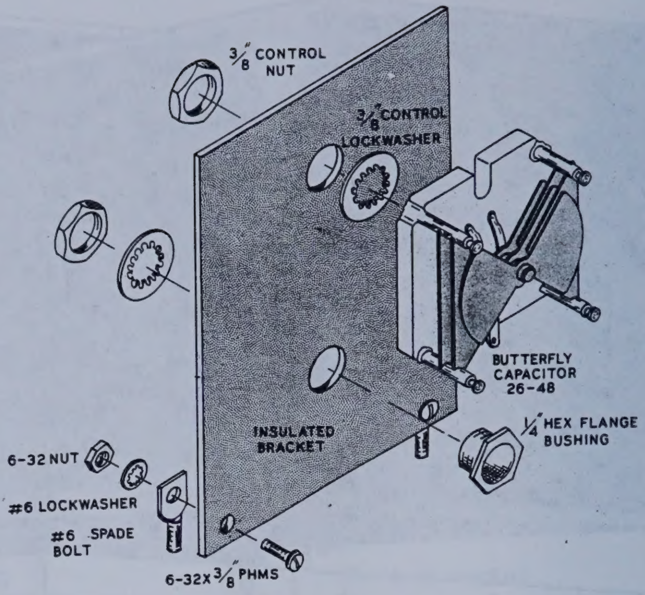

54-73
46-21
V4
V5
N
O
P
Q
R
3
5
6

Pictorial 13

(✓) Locate the insulated final tuning capacitor bracket and mount two spade bolts, using 6-32 x 3/8" screws with #6 lockwashers under the nuts. See Detail 12.

(✓) Mount the 10.5 mmf "butterfly" variable capacitor (#26-48) in the top hole of the insulated bracket, using a 3/8" control lockwasher and securing with a 3/8" control nut, as shown. Position it so that the rotor solder lug is facing toward the other hole in the bracket.

(✓) Mount a 1/4" long hex flange bushing in the bottom hole of the insulated bracket, using a 3/8" control lockwasher under a 3/8" control nut. Insert the bushing from the side, as shown.



Detail 12

(✓) Mount the insulated tuning capacitor bracket on top of the main chassis, inserting the spade bolts in the two slotted holes N and O located on the perforated area. Mount with the body of the "butterfly" variable capacitor facing the back of the chassis. See Pictorial 13. Place #6 lockwashers over the spade bolts protruding through the holes, and secure with 6-32 nuts.

(✓) Mount the two angle brackets from the top side of the main chassis, using 6-32 x 1/4" screws with #6 lockwashers under the nuts on locations P and Q, as shown. Align the tapped part of the bracket parallel to the rear apron of the chassis.

(✓) Locate the power transformer (#54-73) and cut the leads to the following lengths before mounting. Measure from the point they leave the transformer.

Yellow - 9"
Yellow - 9"
Blue - 8"
Blue - 8"
Green - 7"
Green - 3"
Red - 6"
Red - 6"
Black - 8"
Black - 6 1/2"
Blue-Yellow - 7"
Red-Yellow - 6 1/2"
Gray - 5 1/2"
Gray - 4 3/4"

(✓) Strip 3/8" of insulation from each lead and tin.

(✓) Mount the power transformer at the location around grommets C and D. Feed the blue, red, blue-yellow and red-yellow leads through grommet C, and the yellow, green, black and gray leads through grommet D. Secure the transformer with 8-32 x 3/8" screws at the edge of the chassis and use 8-32 x 3/4" screws toward the center of the chassis. Use #8 lockwashers under the 8-32 nuts.

(✓) Locate the high voltage choke (#46-21). Cut both leads to a length of 5", strip 3/8" of insulation and tin. The leads are made this length to clear a part which will be mounted later.

(✓) Mount the choke at the location around grommet A. Feed the leads through the grommet and secure the choke, using four 8-32 x 3/8" screws in the four corner holes. Use #8 lockwashers except at location GL. Install a #8 solder lug here, bending the lug as shown in Pictorial 14 on page 38. Secure with 8-32 nuts. Screws will be placed in the two center holes later.

(✓) Mount the final amplifier housing on the chassis with the opening toward the back of the chassis. Insert the eight spade bolts through the eight matching 5/32" holes in the chassis. Secure the housing, using #6 lockwashers under 6-32 nuts. Mount a 5-lug terminal strip on the protruding spade bolt at location DD, (see Pictorial 14 on page 38) using a #6 lockwasher under the mounting foot and under the nut.

(✓) Loosen the two nuts holding the insulated tuning capacitor bracket in place and slide the bracket so that the "butterfly" capacitor shaft lines up with the insulated coupling. Push the insulated rod so that the coupling slips over the shaft and tighten the Allen setscrew.

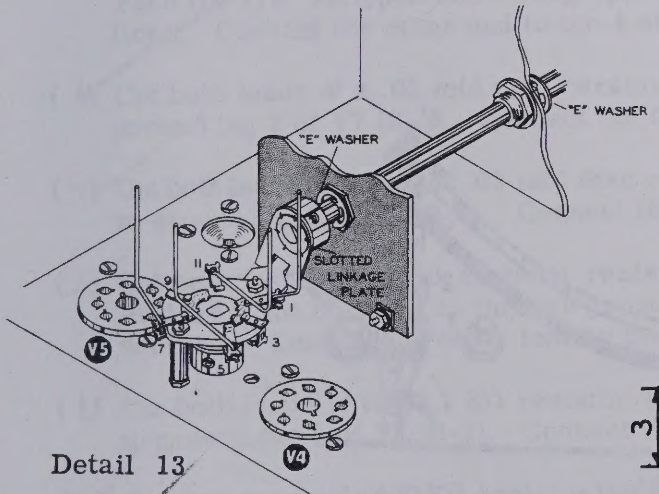
(✓) Locate the 5" long control shaft with two E grooves and a flat on one end of the shaft. Insert this end through the bottom shaft bushing in front of the housing and through the shaft bushing on the insulated bracket. Position the shaft until the two E grooves appear on each side of the two shaft bushings. Place E washers in each of the two grooves on the shaft.

(✓) Tighten the two nuts holding the insulated tuning capacitor bracket in place, positioning the bracket so that the two shafts turn freely.

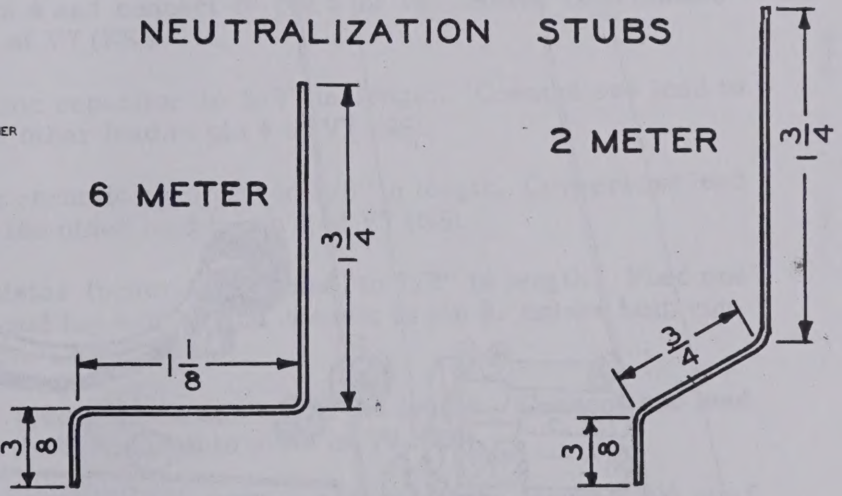
(✓) Locate the slotted band switch linkage plate and start an 8-32 x 1/4" Allen setscrew in the hub. Place the linkage plate on the flat end of the shaft with the hub toward the insulated bracket. Position the slot over the driver band switch linkage plate, as shown in Detail 13. Rotate the shaft until the flat is in line with the setscrew, then tighten the setscrew.

(✓) Bend the two bottom lugs 3 and 9 down at right angles on the neutralization band switch wafer. Cut the two top lugs off close to the ceramic wafer.

(✓) Cut two lengths of #16 bare wire to 3 1/4" and two lengths to 2 7/8". Form the two long wires as shown in Detail 14A, and the two short wires as shown in Detail 14B.



Detail 13

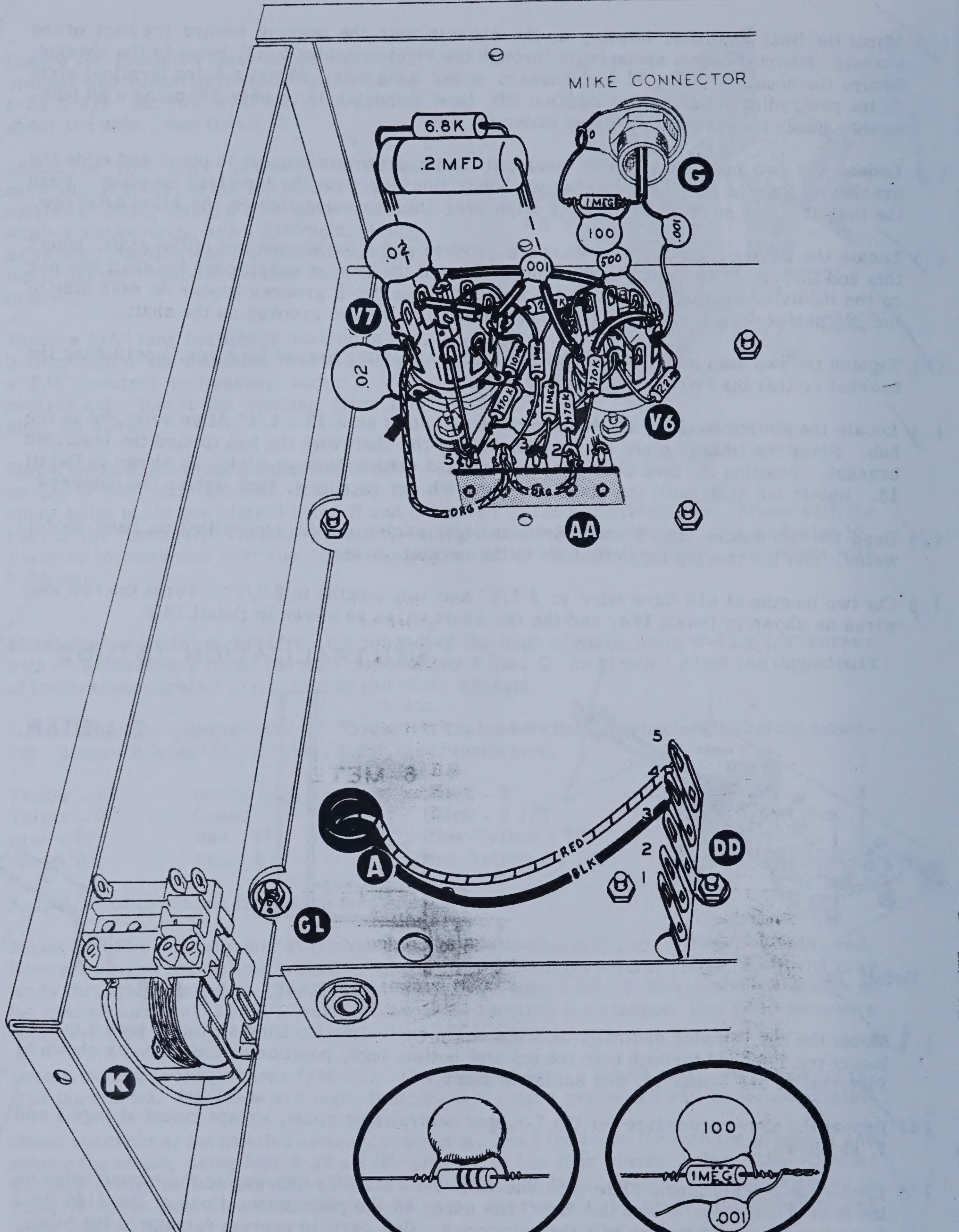


DETAIL 14A & B

(✓) Mount the two 6-meter neutralizing stubs on the neutralization band switch at lugs 5 and 11. Insert the 3/8" end through both the top and bottom lugs, positioning the stubs as shown in Pictorial 13 and Detail 13, and solder in place.

(✓) Repeat the above procedure for the 2-meter neutralizing stubs, except mount at lugs 1 and 7, as shown.

(✓) Locate the two aluminum plate caps and start 6-32 x 1/8" setscrews in the tapped holes on the side of the caps. Place the caps, one each, on the plate connections of the 6146 final amplifier tubes and secure with the setscrews. Use care to prevent damage to the tubes.


MIKE CONNECTOR
6.8K
.2 MFD
G
1MEG
100
.001
.02
.001
500
V7
.02
470K
1MEG
470K
470K
22K
V6
5
4
3
2
1
ORG
AA
5
4
3
2
1
RED
BLK
A
DD
GL
K
100
1MEG
.001

Pictorial 14

(✓) Install the 6146 tubes temporarily in their sockets at V4 and V5, observing the keyway orientation between tube and socket.

(✓) Locate the two silver plated connecting straps. Observe that one of the holes in the strap is located farther from the end of the strap than the other. Insert 6-32 x 1/4" screws through these holes and temporarily mount to the top of the 6146 tube caps. Place the hole in the other end of the straps over the two top stator lugs on the "butterfly" tuning capacitor. Position the straps as shown in Pictorial 13, making sure they do not come in contact with the tuned lines and solder in place. Now remove the two 6146 final amplifier tubes.

This completes the top side assembly. Turn the chassis over with the front towards you.

PRELIMINARY WIRING OF MODULATOR SECTION

(✓) Connect the red lead from the high voltage choke to lug 5 of terminal strip DD (NS). Refer to Pictorial 14.

(✓) Connect the black lead from the high voltage choke to lug 4 of terminal strip DD (NS). Dress both leads as shown.

(✓) Insert a bare wire through the center post of V7, then through pin 5, and connect to ground lug 3. Solder the center post and pin 5.

(✓) Cut a bare wire to 2" in length. Feed one end through pin 9, through the center post, and connect to pin 8 of V6. Solder the center post and pin 8. Connect the other end to lug 3 of terminal strip AA (NS).

(✓) Cut a brown hookup wire to 2 3/4" in length and strip one end 1/2" and the other end 1/4". Feed the 1/2" stripped end through pin 4 and connect to pin 5 of V6. Solder both connections. Connect the other end to pin 4 of V7 (NS).

(✓) Cut both leads of a .02 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to ground lug 2 of V7 (S-1). Connect the other lead to pin 4 of V7 (NS).

(✓) Cut both leads of the other .02 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to ground lug 1 of V7 (S-1). Connect the other lead to pin 1 of V7 (NS).

(✓) Cut both leads of the 10 megohm resistor (brown-black-blue) to 1/2" in length. Feed one lead from the bottom, up through ground lug 4 of V7 and connect to pin 8. Solder both connections. Connect the other lead to pin 7 of V7 (NS).

(✓) Cut both leads of the 2.7 KΩ resistor (red-violet-red) to 1/2" in length. Connect one lead to ground lug 3 of V7 (S-2). Connect the other lead to pin 3 of V6 (NS).

(✓) Cut both leads of a 470 KΩ resistor (yellow-violet-yellow) to 3/4" in length. Mount a 100 mmf disc ceramic capacitor on the resistor as shown in the Insert on Pictorial 14. Solder both connections and clip off the excess capacitor leads.

(✓) Connect one lead of the resistor-capacitor combination to pin 3 of V6 (S-2). Connect the other lead to lug 5 of terminal strip AA (NS).

(✓) Cut a bare wire to 3/4" in length and connect one end to pin 9 of V7 (S-1). Connect the other end to lug 5 of terminal strip AA (NS).

(✓) Cut one lead of a 1 megohm resistor (brown-black-green) to 1 1/4" in length and cut the other lead to 3/8" in length. Bend the long lead at right angles 1/4" away from the body of the resistor. Insert this end through pin 6 of V7, slip a 1/2" length of sleeving over the lead and connect to pin 3. Solder pins 3 and 6. Connect the other lead to lug 4 of terminal strip AA (NS).

(✓) Cut both leads of a 1 megohm resistor (brown-black-green) to 1/2" in length. Connect one lead to lug 3 of terminal strip AA (S-2). Connect the other lead to pin 2 of V6 (NS).

(✓) Cut both leads of a .001 mfd disc ceramic capacitor to 3/4" in length. Slip a 5/8" length of sleeving on each lead. Connect one lead to pin 7 of V7 (S-2). Connect the other lead to pin 1 of V6 (NS).

(✓) Cut both leads of a 470 KΩ resistor (yellow-violet-yellow) to 1/4" in length. Connect one lead to pin 1 of V6 (S-2). Connect the other lead to lug 2 of terminal strip AA (NS).

( ) Cut both leads of a 500 mmf disc ceramic capacitor to 1/2" in length. Connect one lead to pin 2 of V6 (S-2). Connect the other lead to pin 6 of V6 (NS). Mount the capacitor across the socket, as shown.

(✓) Cut both leads of a 470 KΩ resistor (yellow-violet-yellow) to 5/8" in length. Slip a 3/8" length of sleeving over one lead and connect to pin 6 of V6 (S-2). Connect the other lead to lug 2 of terminal strip AA (NS).

(✓) Cut both leads of a 2.2 megohm resistor (red-red-green) to 1/2" in length. Connect one lead to pin 9 of V6 (S-2). Connect the other lead to pin 7 of V6 (NS).

(✓) Mount a 100 mmf disc ceramic capacitor on a 1 megohm resistor (brown-black-green) in the same manner as the 470 KΩ resistor. Solder both connections and cut off the excess capacitor leads. Take a .001 mfd disc ceramic capacitor and wrap one of its leads around one lead of the 1 megohm resistor, soldering lightly. Cut the other resistor lead to 1/2" in length and the other capacitor lead to 1" in length. Slip a 3/4" length of sleeving over the two soldered leads and insert these leads through the eyelet in the mike connector (S-2). Connect the resistor lead to the mike connector ground lug (S-1) and connect the capacitor lead to pin 7 of V6 (S-2). Cut off the excess lead lengths protruding through the mike connector close to the eyelet.

(✓) Cut an orange hookup wire to 1 1/2" in length and strip both ends 1/4". Connect one end to lug 2 of terminal strip AA (S-3). Connect the other lead to lug 4 of terminal strip AA (NS).

(✓) Cut a second orange hookup wire to 2 1/2" in length and strip both ends 1/4". Connect one end to lug 4 of terminal strip AA (S-3). Connect the other end to pin 1 of V7 (NS).

(✓) Cut both leads of the .2 mfd tubular capacitor to 1" in length. Connect one lead to lug 1 (NS) and the other lead to lug 5 (NS) of terminal strip AA. Position the capacitor across the top of the terminal strip.

(✓) Bend both leads of a 6.8 KΩ 2 watt resistor (blue-gray-red) to right angles 3/8" from the body of the resistor. Connect one lead to lug 5 (S-4) and connect the other lead to lug 1 (NS) of terminal strip AA. Position the resistor as shown.

This completes preliminary wiring of the modulator section.

PRELIMINARY WIRING OF POWER SUPPLY SECTION

Connect the following leads from the power transformer as follows, and dress the leads as shown in Pictorial 15 on page 42.

(✓) Short green lead to ground lug 3 of V8 (S-1). The long green lead will be connected later.

(✓) Short gray lead to pin 2 of V8 (S-1).

(✓) Long gray lead to pin 8 of V8 (NS).

(✓) One of the yellow leads to pin 2 of V11 (S-1).

(✓) The other yellow lead to pin 8 of V11 (NS).

(✓) Long black lead to lug 1 of terminal strip KK (NS).

(✓) Short black lead to lug 3 of terminal strip KK (NS).

(✓) One of the blue leads to pin 4 of V11 (S-1).

(✓) The other blue lead to pin 6 of V11 (S-1).

(✓) One of the red leads to pin 4 of V8 (S-1).

(✓) The other red lead to pin 6 of V8 (S-1).

(✓) Blue-yellow lead to lug 4 of terminal strip GG (NS).

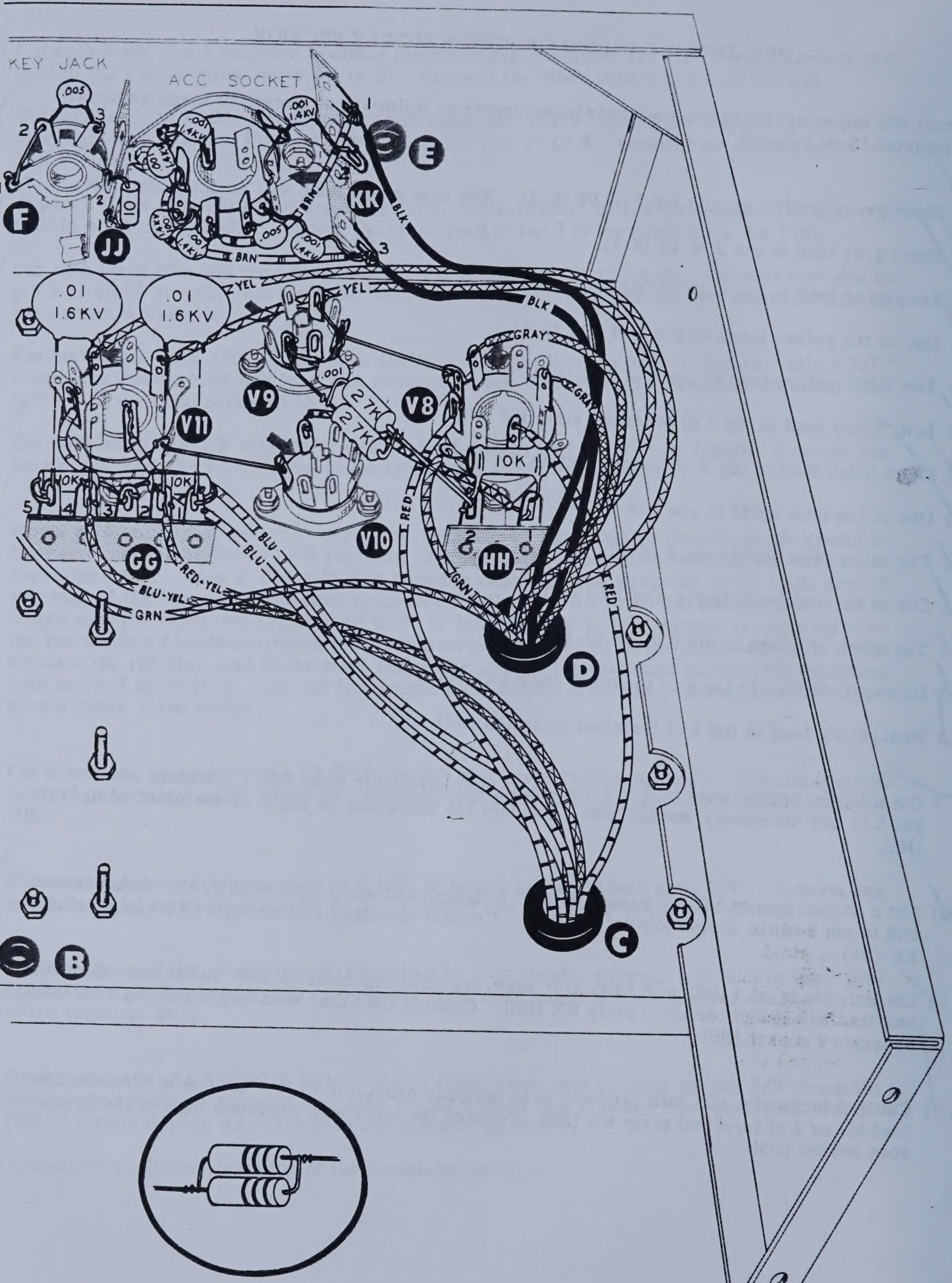
(✓) Red-yellow lead to lug 2 of terminal strip GG (NS).

(✓) Cut a brown hookup wire to 3 1/2" in length and strip both ends 1/4". Connect one end to pin 3 of the accessory socket (NS). Connect the other end to lug 1 of terminal strip KK (NS).

(✓) Cut a second brown hookup wire to 3 1/2" in length and strip both ends 1/4". Connect one end to pin 5 of the accessory socket (NS). Connect the other end to lug 3 of terminal strip KK (NS).

(✓) Cut both leads of a .001 mfd 1400 volt disc ceramic capacitor to 3/8" in length. Connect one lead to lug 3 of terminal strip KK (NS). Connect the other lead to ground lug 1 of the accessory socket (NS).

(✓) Cut both leads of a .001 mfd 1400 volt disc ceramic capacitor to 3/8" in length. Connect one lead to lug 2 of terminal strip KK (NS). Connect the other lead to ground lug 4 of the accessory socket (NS).


KEY JACK
ACC SOCKET
.005
.001 1.4KV
.005
10
1
2
3
E
F
JJ
KK
BRN
BLK
YEL
.01 1.6KV
.01 1.6KV
GRAY
.001
27K
27K
10K
10K
10K
V8
V9
V10
V11
GG
HH
RED
BLU
BLU
GRN
RED-YEL
BLU-YEL
5
4
D
C
B

Pictorial 15

In the next five steps all the capacitors will be mounted on the accessory socket.

(✓) Cut both leads of a .001 mfd 1400 volt disc ceramic capacitor to 3/8" in length. Connect one lead to pin 3 (S-2) and connect the other lead to ground lug 2 (NS).

(✓) Cut both leads of a .001 mfd 1400 volt disc ceramic capacitor to 3/8" in length. Connect one lead to pin 4 (NS) and connect the other lead to ground lug 2 (S-2).

(✓) Cut both leads of a .001 mfd 1400 volt disc ceramic capacitor to 3/8" in length. Connect one lead to pin 5 (NS) and connect the other lead to ground lug 3 (NS).

(✓) Cut both leads of a .001 mfd 1400 volt disc ceramic capacitor to 3/8" in length. Connect one lead to pin 6 (NS) and connect the other lead to ground lug 3 (S-2).

(✓) Cut both leads of a .005 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to pin 2 (NS) and connect the other lead to ground lug 1 (S-2).

(✓) Connect a bare wire from Pin 8 (S-1) to ground lug 4 (S-2).

(✓) Cut one lead of a .005 mfd disc ceramic capacitor to 3/8" in length and the other lead to 3/4". Feed the long lead through lug 2 and connect to lug 1 of the key jack. Solder both connections. Connect the other lead to lug 3 (NS).

(✓) Cut a bare wire to 1 1/2" in length. Feed one end through pin 4 of V9 (NS) and connect to pin 2 (S-1). Connect the other end to ground lug 4 of V8 (S-1).

(✓) Cut both leads of a .001 mfd disc ceramic capacitor to 3/8" in length. Connect one lead to pin 4 of V9 (S-2). Connect the other lead to pin 6 of V9 (NS).

(✓) Cut a bare wire to 1 1/4" in length. Connect one end to pin 7 of V10 (S-1). Connect the other end to ground lug 2 of V11 (S-1).

(✓) Cut an orange hookup wire to 3" in length and strip both ends 1/4". Connect one end to pin 1 of V10 (S-1). Connect the other end to lug 1 of terminal strip HH (NS).

(✓) Parallel two 27 KΩ 2 watt resistors (red-violet-orange) by leaving one lead of each resistor straight and bending the other lead at right angles so they will lay side by side. (See the Insert on Pictorial 15.) Connect each bent lead to the straight lead of the other resistor and solder the junctions. Cut off any excess lead. Cut both straight leads to 3/4" in length.

(✓) Position the resistors as shown and connect one lead to pin 6 of V9 (S-2). Connect the other lead to lug 2 of terminal strip HH (NS).

(✓) Cut both leads of the 10 KΩ 5 watt resistor to 5/8" in length. Connect one lead to lug 1 (S-2) and connect the other lead to lug 2 (NS) of terminal strip HH.

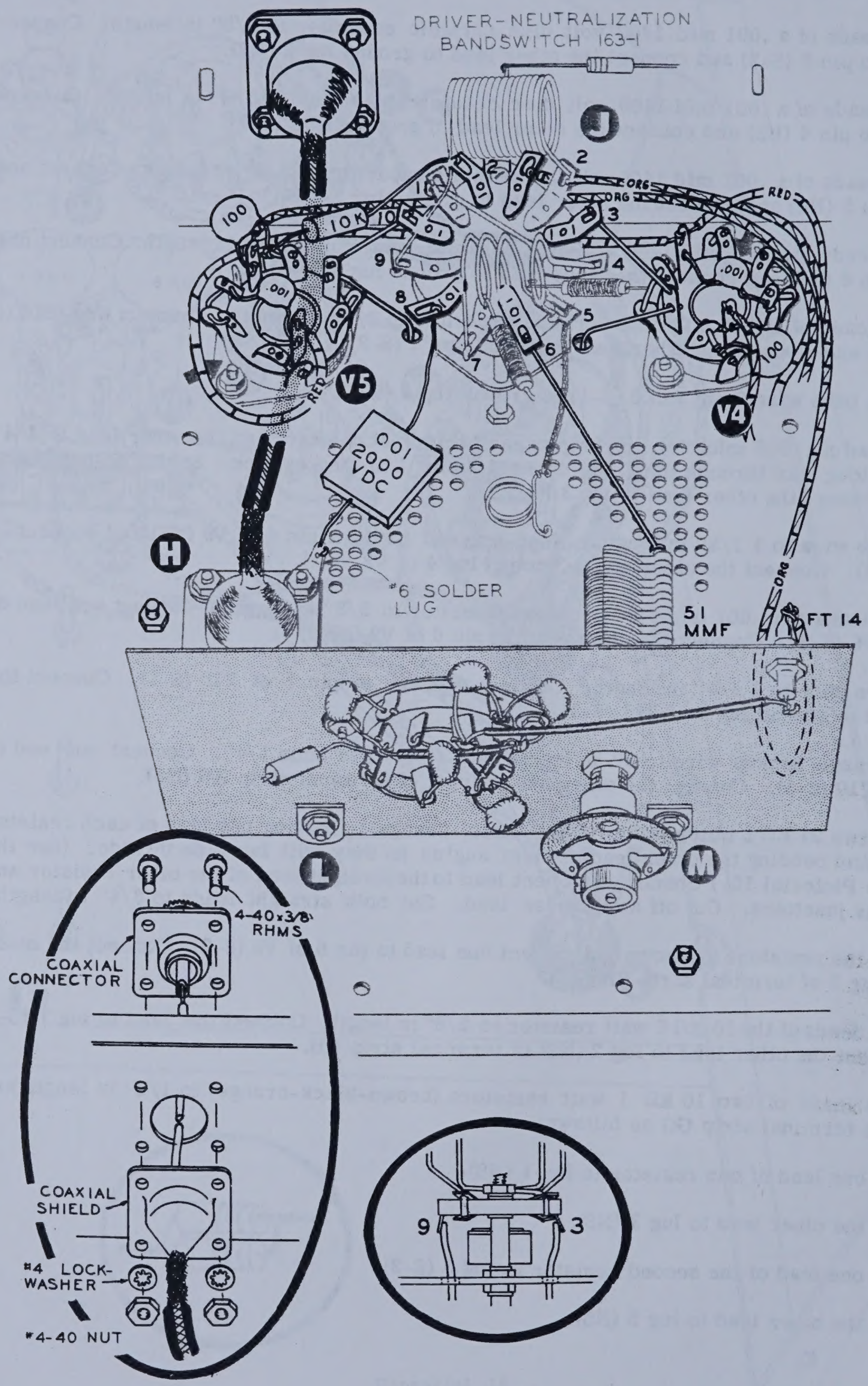
(✓) Cut both leads of two 10 KΩ 1 watt resistors (brown-black-orange) to 1/2" in length and mount on terminal strip GG as follows:

(✓) Connect one lead of one resistor to lug 1 (NS).

(✓) Connect the other lead to lug 3 (NS).

(✓) Connect one lead of the second resistor to lug 3 (S-2).

(✓) Connect the other lead to lug 5 (NS).


DRIVER-NEUTRALIZATION
BANDSWITCH 163-1
J
1
2
3
4
5
6
7
8
9
10
11
12
ORG
ORG
RED
100
10K
.001
V5
RED
V4
.001
2000
VDC
H
#6 SOLDER
LUG
51
MMF
FT 14
ORG
L
M
4-40 x 3/8
RHMS
COAXIAL
CONNECTOR
COAXIAL
SHIELD
#4 LOCK-
WASHER
#4-40 NUT
9
3

Pictorial 16

( ) Cut both leads of two .01 mfd 1.6 kv disc ceramic capacitors to 3/8" in length and mount on terminal strip GG as follows:

( ) Connect one lead of one capacitor to lug 1 (S-2).

( ) Connect the other lead to lug 2 (NS).

( ) Connect one lead of the second capacitor to lug 4 (NS).

( ) Connect the other lead to lug 5 (S-2).

Position the capacitors as shown. When soldering the above terminal strip lugs, avoid any sharp points on the lugs and keep as much clearance as possible between the lugs.

( ) Cut both leads of a 10 Ω precision resistor to 1/2" in length and mount on terminal strip JJ. Connect one lead to lug 1 (S-1). Connect the other lead to lug 2 (NS).

This completes the preliminary wiring of the power supply section.

PRELIMINARY WIRING OF THE DRIVER SECTION

The wiring in this section is quite critical and all lead dress should be followed as shown in Pictorial 16. The tube socket pins that are connected to the socket ground lugs should be bent over toward the ground lug and the shortest possible lead used to connect the two.

Use #16 bare wire in the following steps for the driver section. The length of the bare wire will not be called out here. Insert the bare wire in the pins and lugs and do not try to wrap the wire around the connection. After soldering, cut the remaining bare wire free.

When a step calls for soldering of a bottom hole in a tube socket pin, avoid getting solder in the top hole of the pin for other wires will be connected to the top hole of that same pin later. The following wiring will be around tube socket V4.

( ) ( ) Cut both leads of a .001 mfd disc ceramic capacitor to 3/8" in length. Connect one lead in the bottom hole of pin 7 (S-1). Connect the other lead in the bottom hole of pin 2 (S-1). Mount directly across the socket as shown.

( ) ( ) Insert a bare wire through pin 1, through ground lug 1, then bend the wire up and connect to pin 2. Solder the three connections.

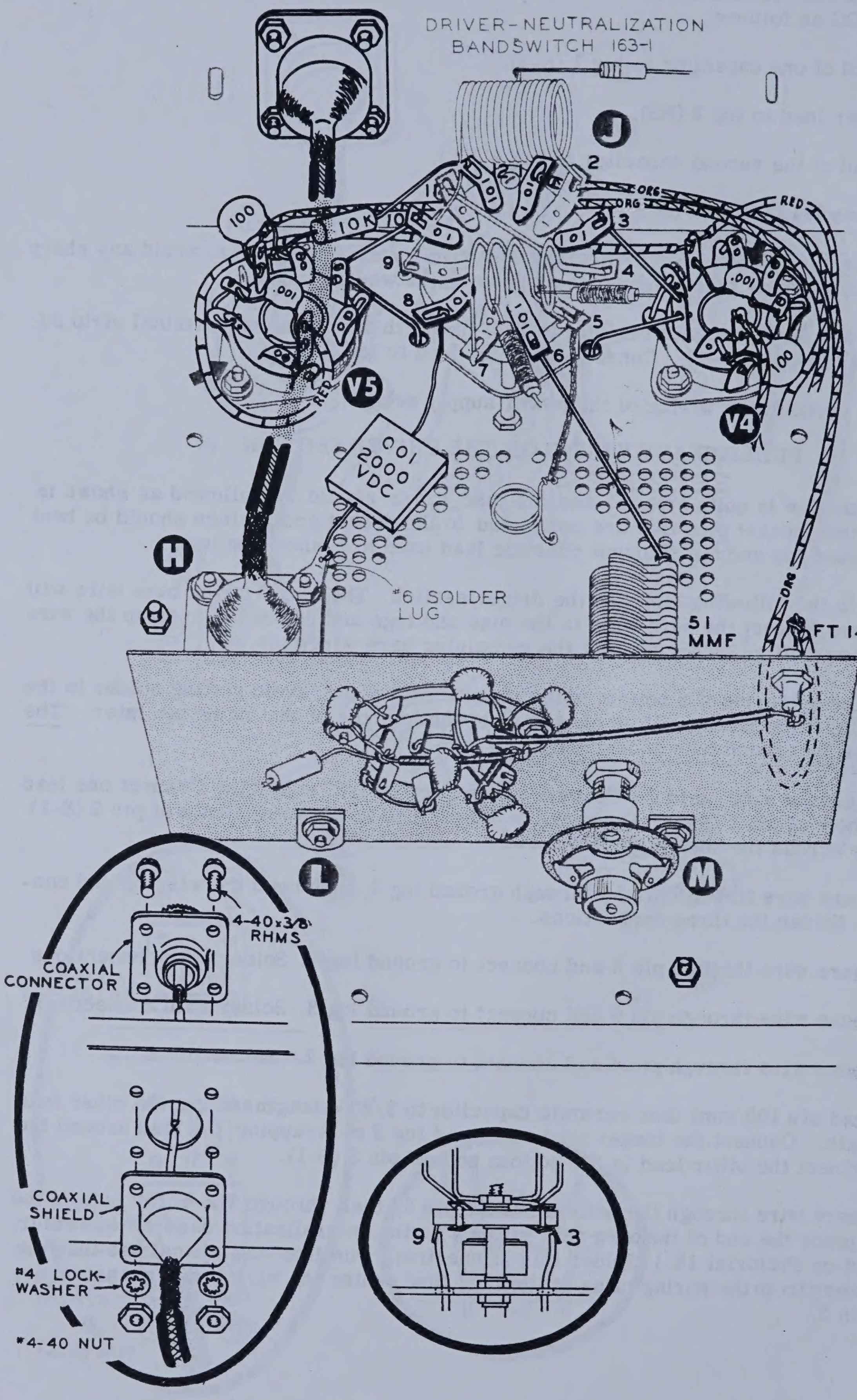
( ) ( ) Insert a bare wire through pin 8 and connect to ground lug 4. Solder both connections.

( ) ( ) Insert a bare wire through pin 6 and connect to ground lug 3. Solder both connections.

( ) ( ) Insert a bare wire through pin 4 and connect to ground lug 2. Solder pin 4.

( ) ( ) Cut one lead of a 100 mmf disc ceramic capacitor to 3/8" in length and cut the other lead to 1/4" in length. Connect the longer lead to ground lug 2 by wrapping the lead around the lug (S-2). Connect the other lead in the bottom hole of pin 3 (S-1).

( ) ( ) Insert a bare wire through the bottom hole of pin 5, then through the 5/16" hole in the chassis, and place the end of the wire next to lug 3 on the neutralization band switch wafer. (See the Insert on Pictorial 16.) Solder this connection. Position the chassis so that the solder flows away from the spring clips of the lug. Now center the wire in the chassis hole, then solder pin 5.


DRIVER-NEUTRALIZATION
BANDSWITCH 163-1
J
2
ORG
ORG
RED
1
12
100
10K
10
101
3
9
4
.001
8
5
6
7
V5
RED
V4
100
.001
2000
VDC
H
#6 SOLDER
LUG
51
MMF
FT 14
ORG
L
M
4-40x3/8
RHMS
COAXIAL
CONNECTOR
COAXIAL
SHIELD
#4 LOCK-
WASHER
#4-40 NUT
9
3

Pictorial 16

( ) (✓) Insert a bare wire through lug 3 of the driver band switch wafer, form a small right angle bend at the end of the wire, and insert in the top hole of pin 5. Solder both connections.

(✓) REPEAT ALL of the preceding steps with the double check spaces for wiring of tube socket V5. The procedure will be identical, except that the bare wires will be connected to neutralization band switch lug 9 and driver band switch lug 10. NOTE: Tube socket position is reversed.

(✓) Cut a bare wire to 2 1/4" in length. Connect one end to lug 6 of the driver band switch (S-1). Connect the other end to the stator lug on the 51 mmf variable capacitor (S-1).

(✓) Cut one lead of the 1000 mmf (.001) 2000 volt mica capacitor to 1" in length and cut the other lead to 3/8" in length. Bend the long lead to right angles close to the capacitor body. Connect this lead to lug 8 of the driver band switch (S-1). Connect the other lead to the #6 solder lug (S-1).

(✓) Cut both leads of a 10 KΩ 1 watt resistor (brown-black-orange) to 1/2" in length. Bend one lead to right angles near the resistor body and connect to lug 12 of the driver band switch (S-1). Connect the other lead to ground lug 2 of V5. Wrap the lead around the connecting wire between pin 4 and ground lug 2 and solder.

(✓) Cut an orange hookup wire to 9" in length and strip both ends 1/4". Connect one end to lug 1 of the driver band switch (S-1). Connect the other end to FT14 (NS). Dress the lead as shown.

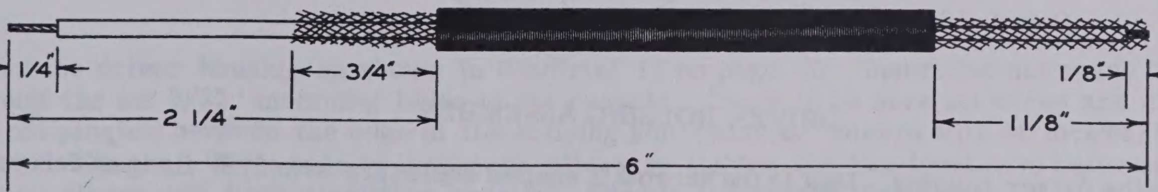
(✓) Cut an orange hookup wire to 8 1/2" in length and strip both ends 1/4". Connect one end to pin 3 of V5 (S-1). Dress the lead as shown. The other end will be connected later.

(✓) Cut an orange hookup wire to 2 3/4" in length and strip both ends 1/4". Connect one end to pin 3 of V4 (S-1). The other end will be connected later.

(✓) Cut a #18 (heavy) hookup wire to 8" in length and strip both ends 1/4". Connect one end to pin 7 of V5 (S-1). Connect the other end to pin 7 of V4 (NS). Dress the wire as shown.

(✓) Cut a second #18 hookup wire to 3 1/2" in length and strip both ends 1/4". Connect one end to pin 7 of V4 (S-2). The other end will be connected later.

(✓) Prepare the short length of coaxial cable as shown in Detail 15.



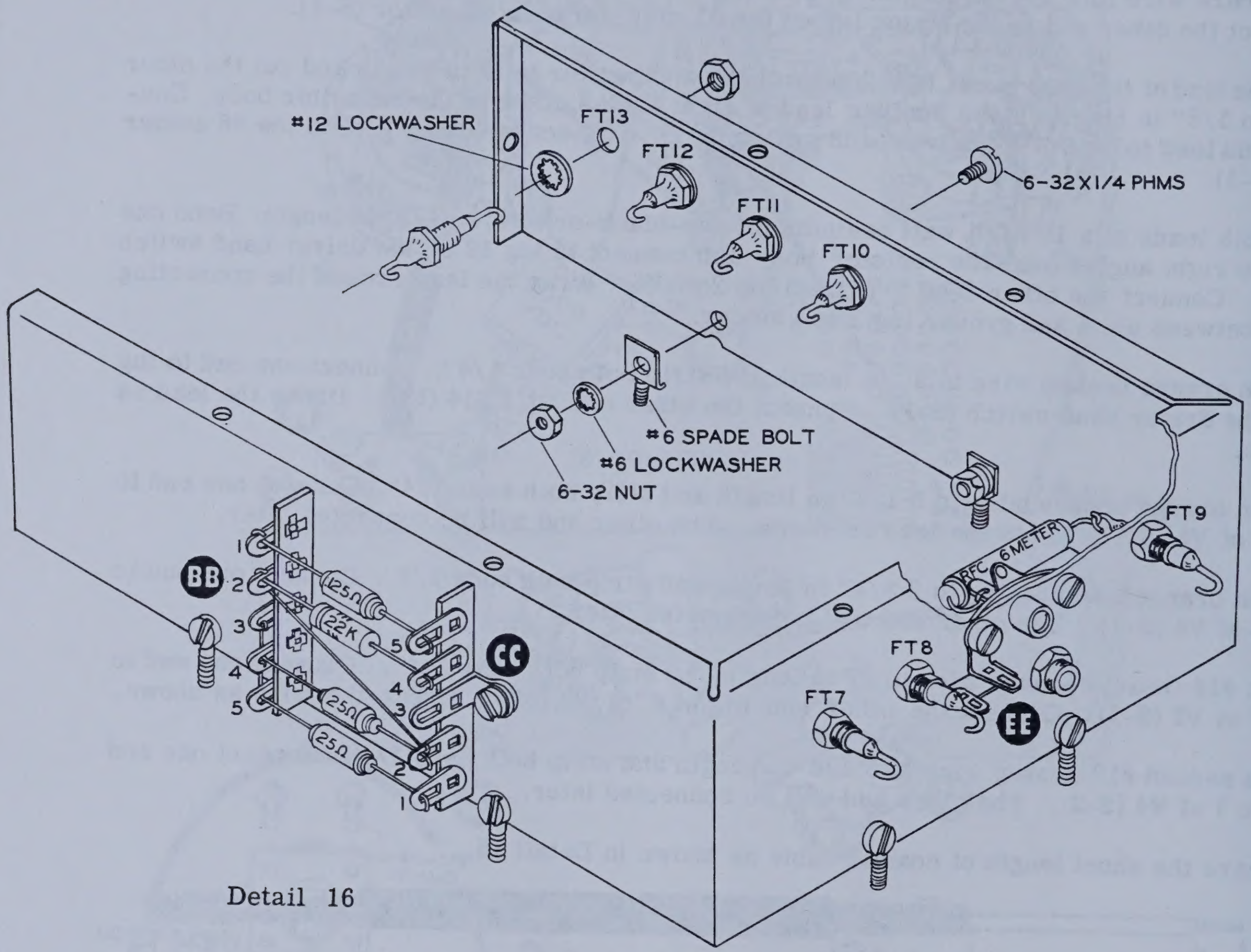
Detail 15

(✓) Strip the outer jacket from one end for a distance of 2 1/4", then cut the shield off at a point 3/4" from the outer jacket. Strip the inner conductor 1/4" and tin. Strip the outer jacket from the other end for a distance of 1 1/8". Push back the shield, strip the inner conductor 1/8" and tin.

(✓) Install the coaxial connector with one 4-40 x 3/8" screw temporarily. Fill the center lug of the connector with solder. Slip the coaxial connector shield, neck first, over the inner conductor of the end stripped 1 1/8" so that the neck slides under the braid. Now solder the inner conductor to the center lug of the connector. Remove the temporary mounting screw and complete mounting of the connector and shield, using 4-40 x 3/8" screws with #4 lockwashers under the nuts. Then, solder the braid to the shield neck. Take care not to overheat the shield and cause the inner conductor insulation to melt.

(✓) Slip the inner conductor of the other end of the coaxial cable through the coaxial shield previously mounted on the chassis. Slip the coaxial braid over the neck of the shield and solder. Connect the inner conductor to the #6 solder lug mounted on the ceramic standoff. Insert the tinned lead through the hole near the mounting hole of the solder lug. Slip the braid from the link coupling coil over the end of the solder lug and solder both connections.

This completes preliminary wiring of the driver section.


#12 LOCKWASHER
FT13
FT12
FT11
FT10
6-32 X 1/4 PHMS
#6 SPADE BOLT
#6 LOCKWASHER
6-32 NUT
FT9
RFC 6 METER
FT8
FT7
EE
BB
CC
1
2
3
4
5
125Ω
22K
25Ω
25Ω
5
4
3
2
1

Detail 16

DRIVER HOUSING ASSEMBLY

(✓) Locate the driver housing. This is the narrow U shaped enclosure with 3/8" flanges across the bottom and back. See Detail 16.

(✓) Mount six spade bolts, using 6-32 x 1/4" screws with #6 lockwashers under the nuts. Mount the spade bolts with the mounting flange on the inside of the housing, as shown.

(✓) Mount seven .001 mfd feed-through type capacitors at locations marked FT7 through FT13. Mount with a #12 lockwasher under the mounting flange of each capacitor, inserting the capacitors through the holes from the inside of the housing. Position the hooks as shown and secure with the nuts supplied with the units.

(✓) Mount a phono socket, using 6-32 x 1/4" hardware with a 2-lug terminal strip under the screw head at location EE. Position the phono socket with the ground lug near the flange of the housing.

(✓) Place a thin control lockwasher on a 1/4" long hex flanged shaft bushing and mount in the 25/64" hole, inserting through the hole from the inside of the housing. Secure with a 3/8" control nut.

(✓) Mount two 5-lug terminal strips at locations marked "BB" and "CC". Use 6-32 x 1/4" screws, #6 lockwashers under the screw heads and under the mounting foot of the terminal strips. Also place #6 lockwashers under the nuts. Position the terminal strips as shown.

(✓) Cut both leads of a 6-meter RF choke to 5/8" in length. Connect one lead to FT9 (S-1). Connect the other lead to the center lug of the phono socket (NS).

(✓) Cut a bare wire to 2 1/4" in length. Connect one end to lug 2 of terminal strip BB (NS). Connect the other end to lug 2 of terminal strip CC (NS).

(✓) Cut both leads of the 22 KΩ 1 watt resistor (red-red-orange) to 5/8" in length. Connect one lead to lug 2 of terminal strip BB (S-2). Connect the other lead to lug 4 of terminal strip CC (NS).

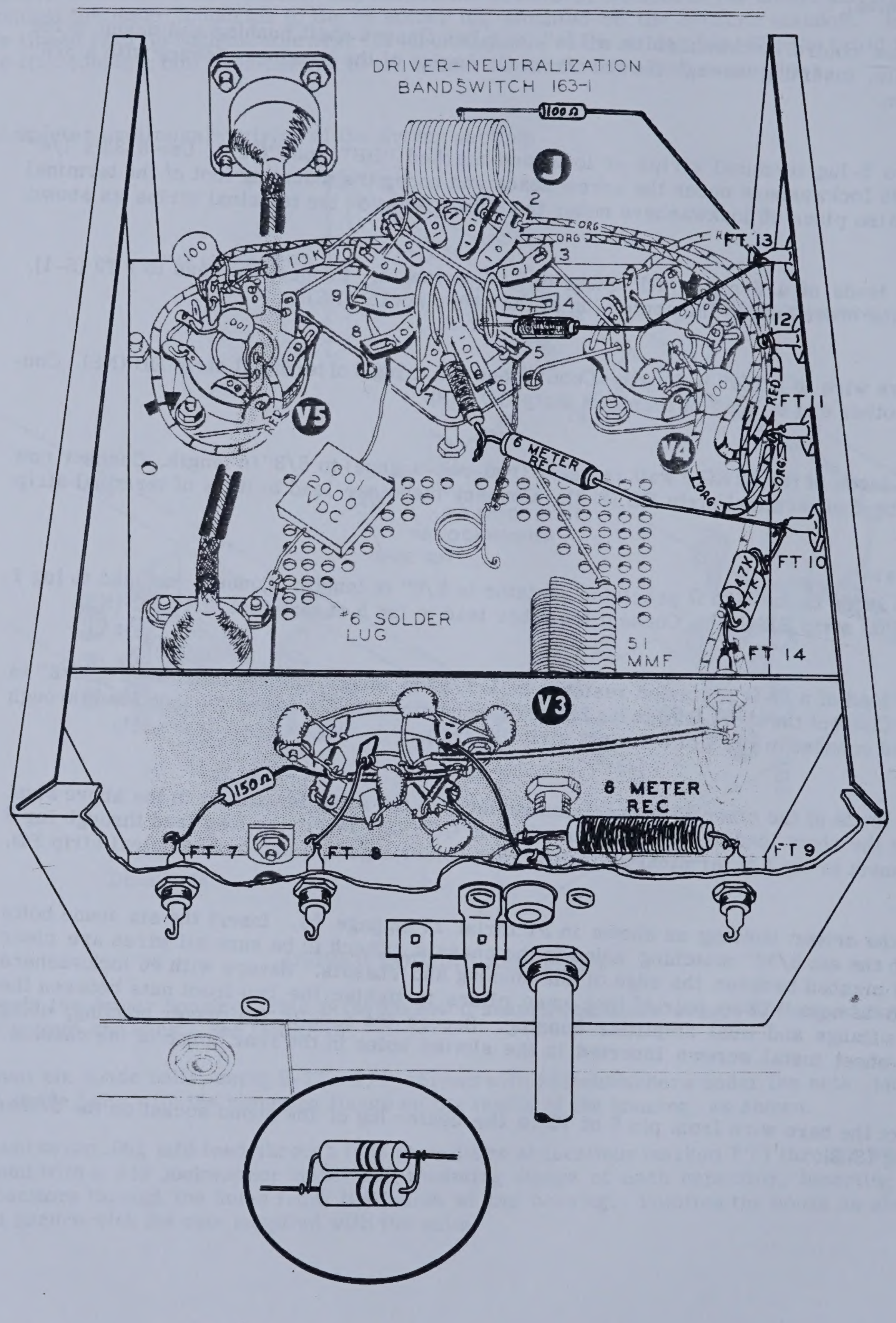
(✓) Cut both leads of the .125 Ω precision resistor to 5/8" in length. Connect one lead to lug 1 of terminal strip BB (NS). Connect the other lead to lug 5 of terminal strip CC (NS).

( ) Cut one lead of a 25 Ω precision resistor to 1 1/8" in length and the other lead to 5/8" in length. Connect the short lead to lug 2 of terminal strip CC (NS). Insert the long lead through lug 4 and connect to lug 3 of terminal strip BB (NS).

(✓) Cut the leads of the other 25 Ω precision resistor to the same lengths as in the above step. Connect the short lead to lug 1 of terminal strip CC (NS). Insert the long lead through lug 5 and connect to lug 4 of terminal strip BB. Now solder lugs 3, 4 and 5 of terminal strip BB.

(✓) Mount the driver housing as shown in Pictorial 17 on page 50. Insert the six spade bolts through the six 5/32" matching holes in the chassis. Check to be sure all wires are clear and not pinched between the edge of the housing and chassis. Secure with #6 lockwashers under 6-32 nuts. Use a pair of long-nose pliers to tighten the two front nuts between the chassis flange and final amplifier housing. Secure the back of the driver housing, using two #6 sheet metal screws inserted in the slotted holes in the rear apron of the chassis.

(✓) Connect the bare wire from pin 5 of V3 to the center lug of the phono socket on the driver housing (S-2).


DRIVER-NEUTRALIZATION
BANDSWITCH 163-1
100Ω
J
1
2
3
4
5
6
7
8
9
10
11
12
ORG
ORG
FT 13
FT 12
FT 11
RED
100
10K
100
.001
V5
RED
V4
6 METER
REC
ORG
ORG
.001
2000
VDC
#6 SOLDER
LUG
51
MMF
FT 10
47K
47K
FT 14
V3
150Ω
6 METER
REC
FT 7
FT 8
FT 9

Pictorial 17

(✓) Connect the bare wire from ground lug 2 of V3 to the ground lug of the phono socket (S-1).

(✓) Connect the free lead of the 150 Ω 1 watt resistor to FT7 (S-1).

(✓) Connect a bare wire between pin 2 of V3 (S-2) and FT8 (S-1).

(✓) Locate the 4 1/4" long plain shaft and insert through the shaft bushing on front of the driver housing. Insert into the flexible coupling until the shaft end is even with the back edge of the hub, then tighten the two setscrews. Now check the grid compartment of the driver housing and make sure there are no leads shorting and that the flexible coupling has room to rotate.

(✓) Connect the free ends of the two orange leads to FT11 (S-2).

(✓) Connect the free end of the #18 heavy lead to FT12 (S-1).

(✓) Connect the free lead from the 100 Ω resistor to FT13 (NS).

(✓) Connect the free lead from the 2-meter RF choke that is connected to the 1-turn coil, to FT13 (S-2).

(✓) Locate the remaining 6-meter RF choke and connect to the free end of the 2-meter RF choke which is connected to the 3-turn coil. Twist the two leads together close to the body of the two chokes. Solder the connection and cut off the excess leads.

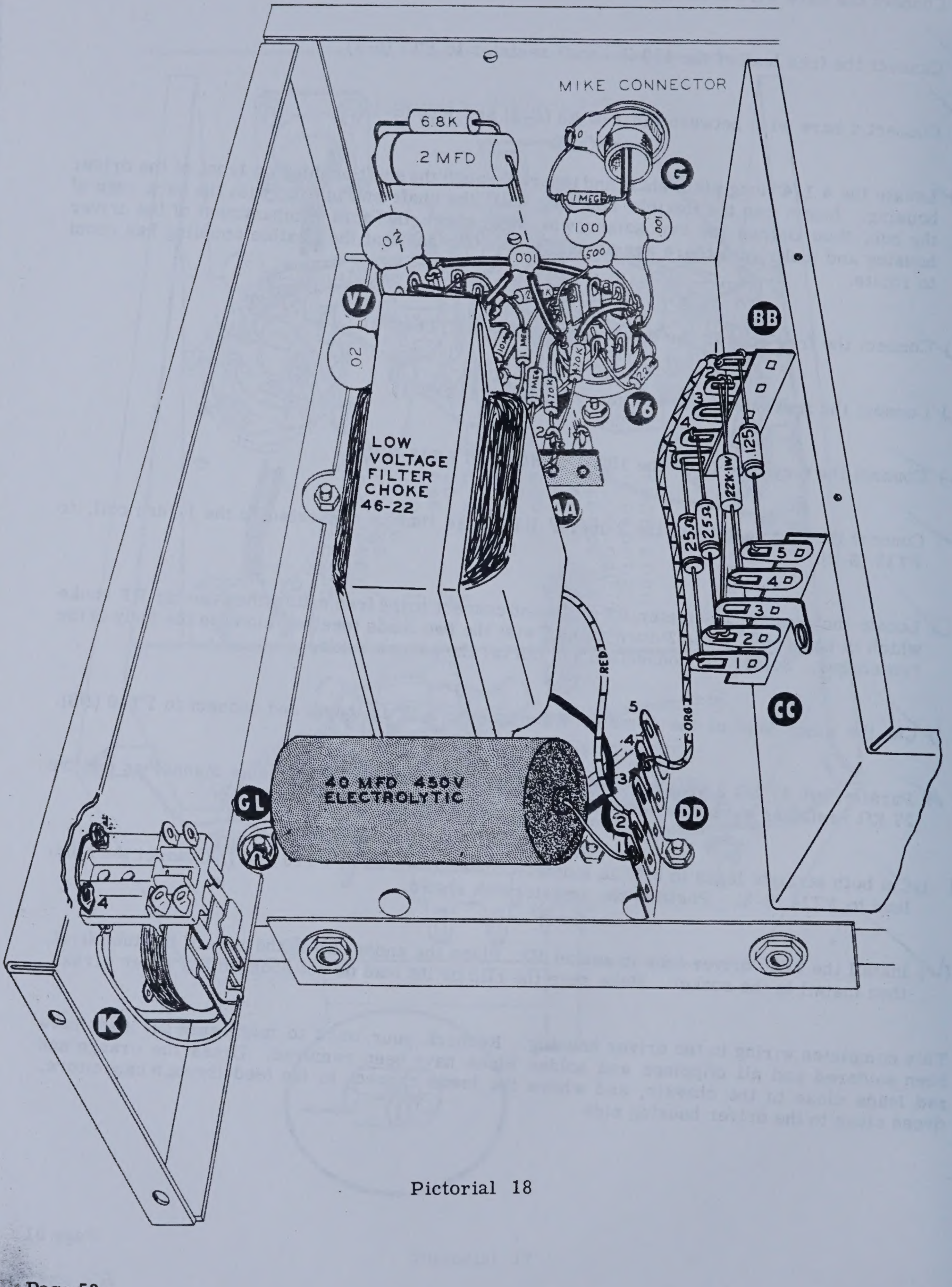
(✓) Cut the other lead of the 6-meter RF choke to 5/8" in length and connect to FT10 (NS).

(✓) Parallel two 47 KΩ 2 watt resistors (yellow-violet-orange) in the same manner as the two 27 KΩ resistors were connected together. See the Insert on Pictorial 17.

( )✓ Cut both straight leads to 5/8" in length. Connect one lead to FT10 (S-2). Connect the other lead to FT14 (S-2). Position the resistors as shown.

(✓) Install the 2E26 driver tube in socket V3. Place the anode clip on the plate of the tube first, then install in the socket. Make sure the clip or its lead do not short to any other wires.

This completes wiring in the driver housing. Recheck your work to make sure all leads have been soldered and all clippings and solder blobs have been removed. Dress the orange and red leads close to the chassis, and where the leads connect to the feed-through capacitors, dress close to the driver housing side.


MIKE CONNECTOR
6.8K
.2 MFD
G
1 MEG
100
.001
.02
.001
500
V7
BB
.02
10K
1 MEG
1 MEG
470K
470K
22K
V6
1
2
3
4
LOW VOLTAGE FILTER CHOKE 46-22
AA
.125
22K-1W
25Ω
25Ω
5D
4D
3D
2D
1D
CC
RED
ORG
5
4
3
2
1
DD
40 MFD 450V ELECTROLYTIC
GL
4
K

Pictorial 18

WIRING IN MODULATOR SECTION

(✓) Cut an orange hookup wire to 6" in length and strip both ends 1/4". Connect one end to lug 1 of terminal strip BB (S-2). Connect the other end to lug 4 of terminal strip DD (NS). Dress the lead as shown in Pictorial 18.

(✓) Locate the low voltage filter choke (#46-22) and cut both leads to a length of 4". Strip both leads 1/4" and tin.

(✓) Mount the choke using 8-32 x 3/8" screws inserted in the two center holes of the high voltage choke. Secure with #8 lockwashers under the nuts. If necessary, push the .2 mfd tubular capacitor out of the way to install the lockwasher and nut on that side of the choke. Center the choke between the two mounting screws so that both nuts seat on the mounting flange.

( ) Connect the black lead from the choke to lug 1 of terminal strip DD (NS). Connect the red lead to lug 2 of the same terminal strip (NS).

(✓) Locate the 40 mfd, 450 volt electrolytic capacitor and cut both leads to 3/4" in length. Connect the negative (-) lead to the #8 solder lug at location GL (S-1). Connect the positive (+) lead to lug 1 of terminal strip DD (NS). Position the capacitor as shown.

(✓) Connect a bare wire from lug 1 (S-1) to lug 4 (NS) of the relay.

WIRING IN POWER SUPPLY SECTION

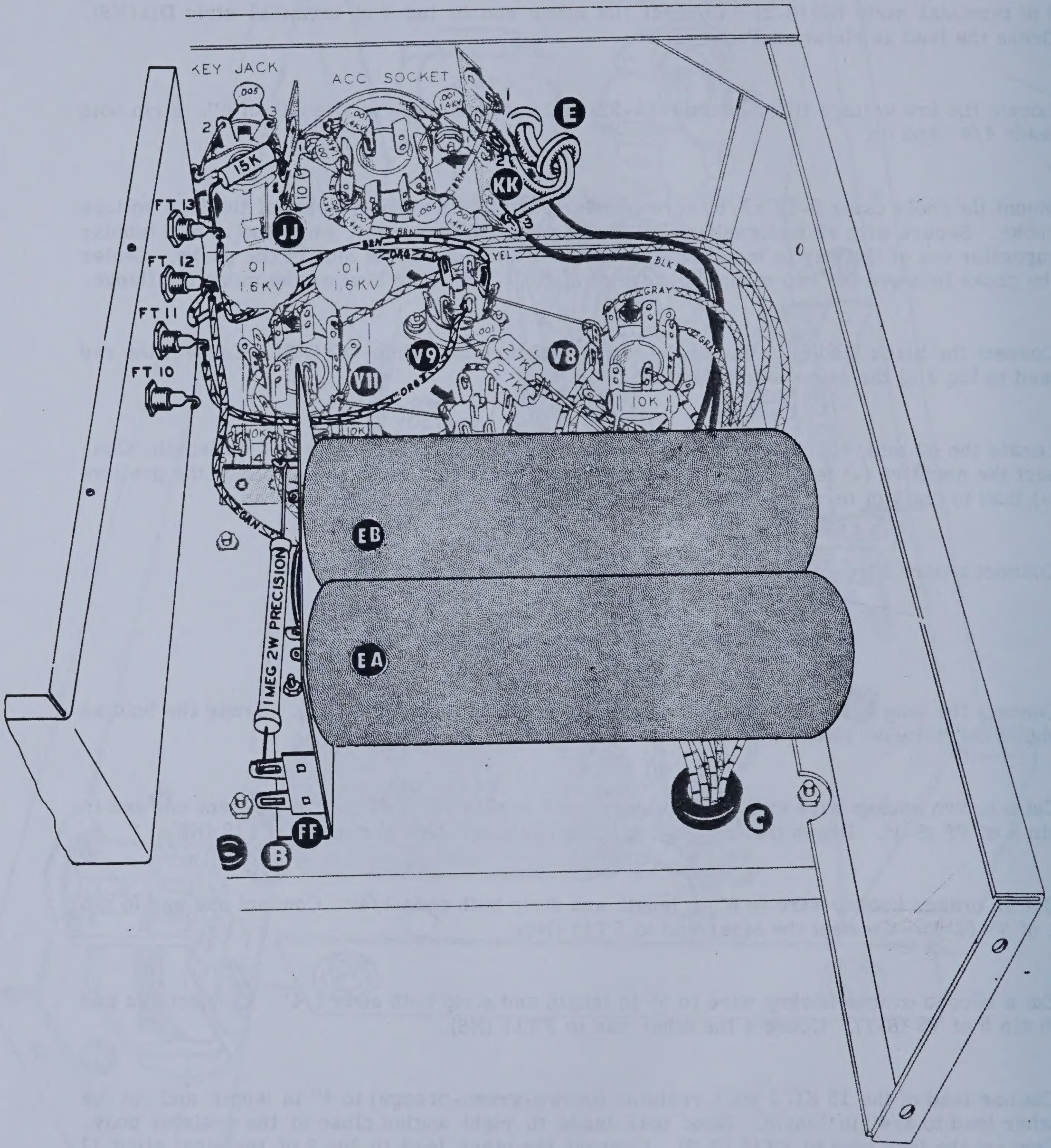
(✓) Connect the long green wire from the power transformer to FT12 (NS). Dress the lead as shown in Pictorial 19 on page 54.

(✓) Cut a brown hookup wire to 7 1/2" in length and strip both ends 1/4". Connect one end to pin 3 of V9 (S-1). Dress the lead as shown and connect the other end to FT12 (NS).

( ) Cut an orange hookup wire to 6" in length and strip both ends 1/4". Connect one end to pin 1 of V9 (S-1). Connect the other end to FT13 (NS).

(✓) Cut a second orange hookup wire to 6" in length and strip both ends 1/4". Connect one end to pin 5 of V9 (S-1). Connect the other end to FT11 (NS).

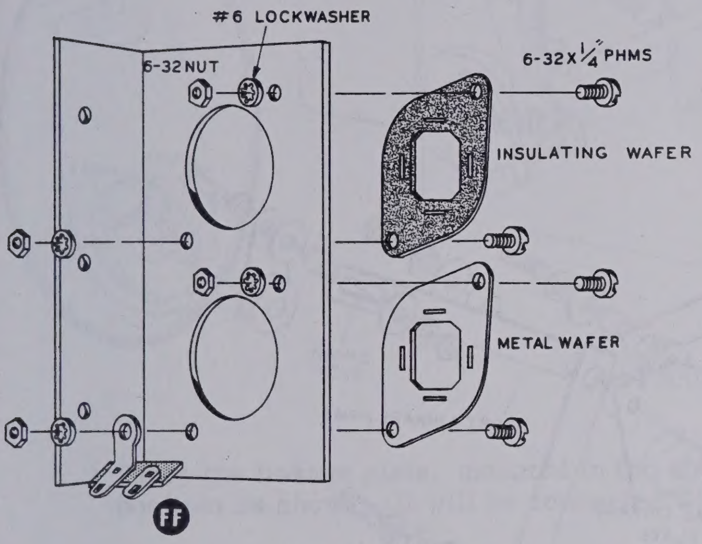
(✓) Cut one lead of the 15 KΩ 1 watt resistor (brown-green-orange) to 1" in length and cut the other lead to 3/4" in length. Bend both leads to right angles close to the resistor body. Connect the long lead to FT13 (S-2). Connect the other lead to lug 2 of terminal strip JJ (NS).


KEY JACK
ACC SOCKET
E
KK
JJ
15K
.005
.001 1.4KV
FT 13
FT 12
FT 11
FT 10
.01 1.5KV
.01 1.5KV
BRN
ORG
YEL
BLK
GRAY
V11
V9
V8
.001
27K
27K
10K
10K
10K
GRN
EB
EA
1 MEG 2W PRECISION
FF
B
C

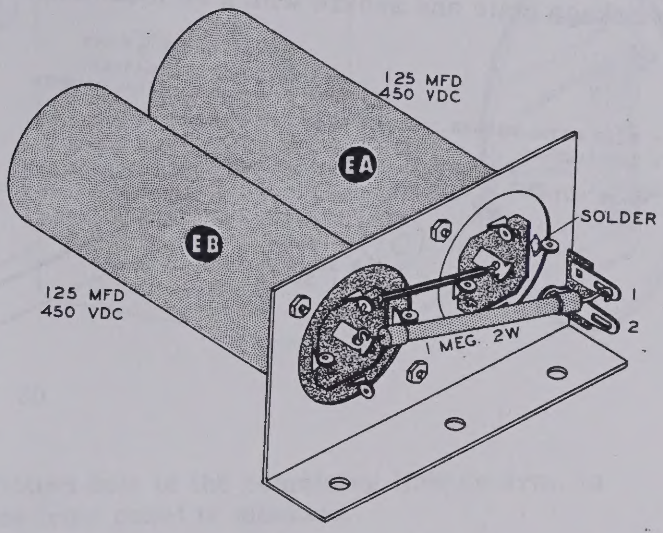
Pictorial 19

( ) Locate the AC line cord and separate the two wires 1 1/2" in length on one end. Strip 1/4" insulation from each lead and tin. Insert this end through grommet E and tie a knot about 1 1/2" from the end of the cord. Connect one lead to lug 3 of terminal strip KK (S-4). Connect the other lead to lug 2 of terminal strip KK (NS).

( ) Locate the L shaped bracket with two large holes in it. Mount the insulated and metal capacitor mounting wafers on the bracket from the side, as shown in Detail 18A. Use 6-32 hardware. Place a 2-lug terminal strip under the mounting nut and lockwasher at location FF and position as shown.



Detail 18A



Detail 18B

( ) Mount the two 125 mfd, 450 volt electrolytic capacitors, orienting with the single center lug as shown in Detail 18B. Secure to the wafers, by twisting the four outer lugs of each capacitor with a pair of pliers. Twist to about a 45° angle.

( ) Cut both leads of the 1 megohm 2 watt precision resistor to 3/4" in length. Connect one lead to lug 1 of terminal strip FF (NS). Connect the other lead to the center lug of filter capacitor EB (NS).

( ) Cut a bare wire to 2" in length. Connect one end to the center lug of filter capacitor EA (S-1). Slip a 1 1/2" length of sleeving over the other end and connect to the top outer lug of filter capacitor EB (NS).

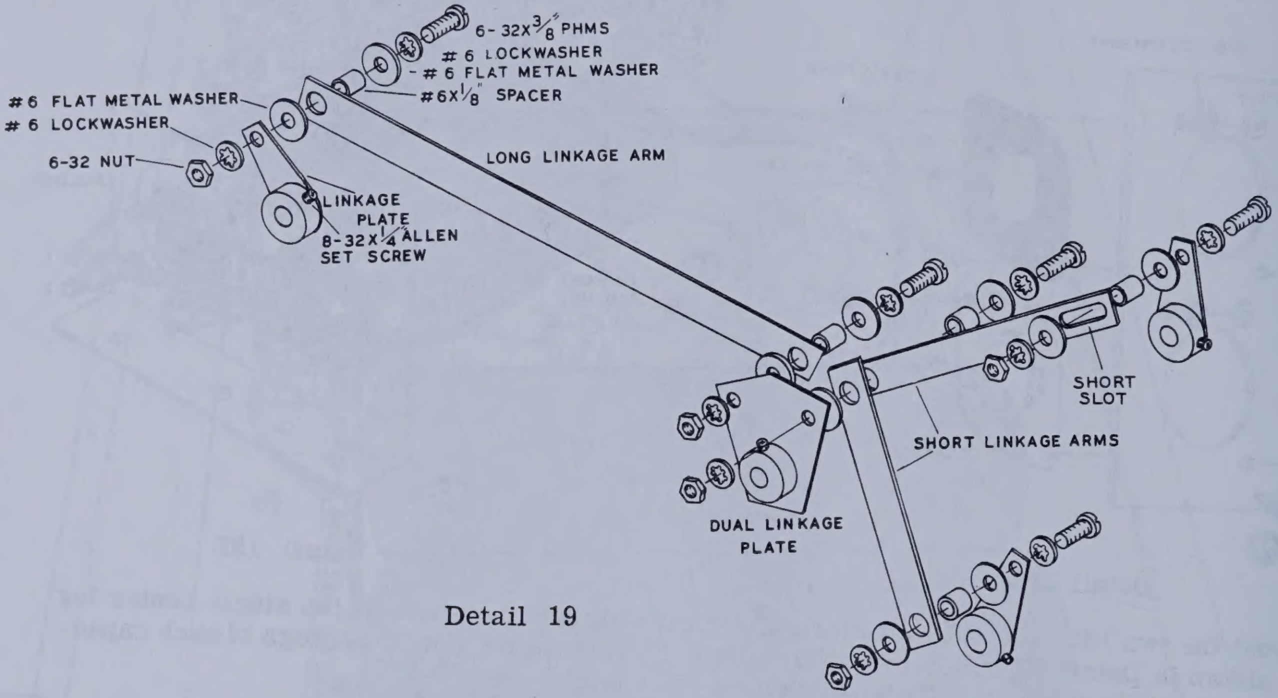
( ) Solder the plain outer lug of filter capacitor EA to the metal wafer.

( ) Install the filter capacitor bracket by placing the flange over the three protruding 8-32 x 3/4" screws. Secure with #8 lockwashers under 8-32 nuts.

This completes all preliminary wiring on the main chassis.

LINKAGE ASSEMBLY AND INSTALLATION

( ) See Detail 19 and locate the three linkage plates, the dual linkage plate, the long linkage arm, the short linkage arm, and the linkage arm with the short slotted hole in one end. Start 8-32 x 1/4" Allen setscrews in the hubs of each of the linkage plates. Refer to Detail 19 for the link drive assembly. When securing the plates to the arms, use 6-32 x 3/8" screws. Place a #6 lockwasher on each screw, then a #6 flat washer, a #6 x 1/8" spacer, the linkage arm, and then another #6 flat washer. Insert the screw through the hole in the linkage plate and secure with a #6 lockwasher under the nut.



Detail 19

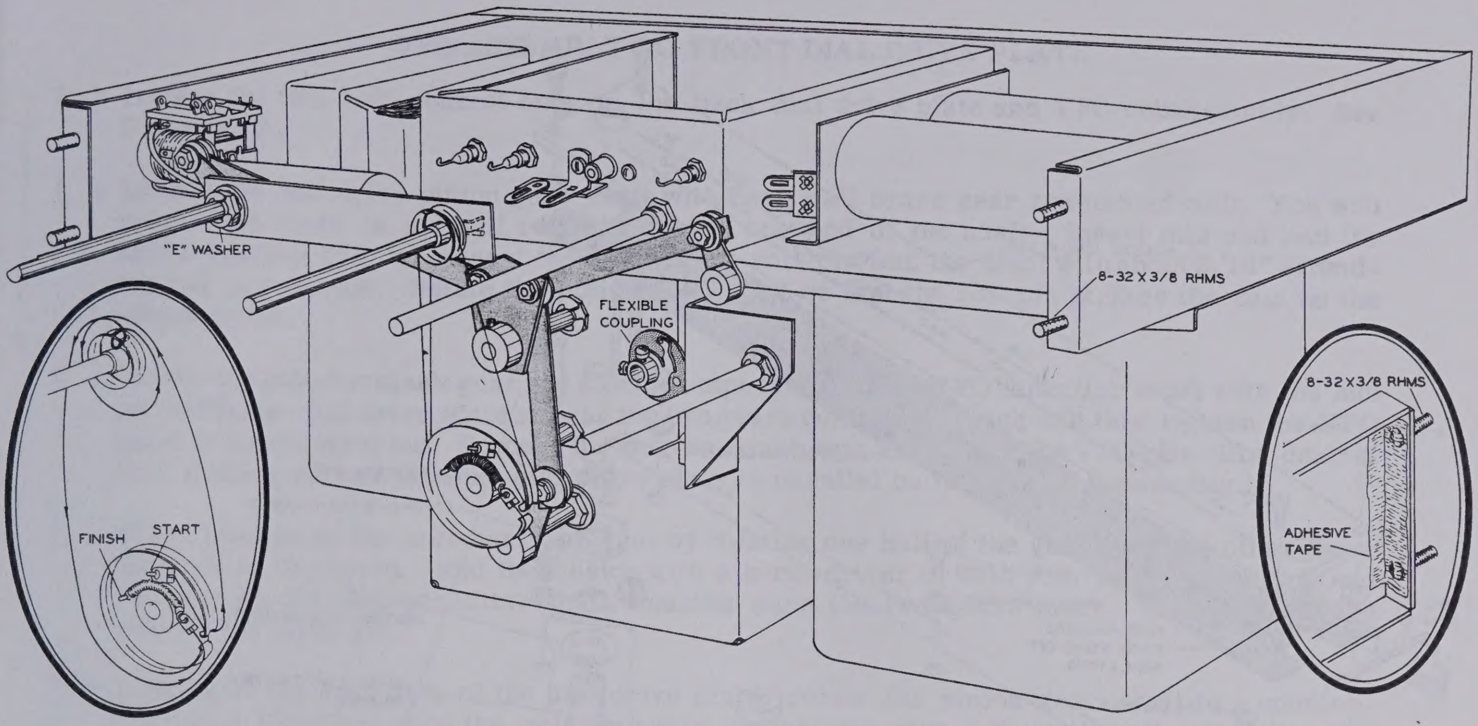
( ) Referring to Pictorial 20 place a flexible coupling on the 75 mmf loading capacitor shaft mounted in the final amplifier housing, positioning the inside edge of the hub even with the end of the shaft. Tighten the two setscrews.

( ) Rotate the driver-neutralization band switch shaft full CCW, or in the 2-meter position. This is the position when the two flats on the driver band switch shaft are in line with the two mounting screws of the band switch. Rotate the final tank band switch blades, so they engage the two tabs on the tuned lines.

( ) Referring to Pictorial 20, place the dual linkage plate on the driver-neutralization band switch shaft. Position the linkage plate as shown, aligning the hub flush with the end of the shaft. Tighten the Allen setscrew.

( ) Place the linkage plate, mounted at the end of the short linkage arm, on the insulated final tank band switch shaft. Align the edge of the hub with the end of the shaft and tighten the setscrew.

( ) Locate the 3 3/8" long shaft with an E groove on one end and a flat on the other end. Place an E retaining washer in the E groove and insert this end of the shaft into the shaft bushing located near the relay on the control shaft support bracket. Place the linkage plate mounted on the long linkage arm on the protruding end of the shaft and place the hub next to the shaft bushing so there is no end play on the shaft. Position the flat on the shaft, as shown, and tighten the setscrew.



Pictorial 20

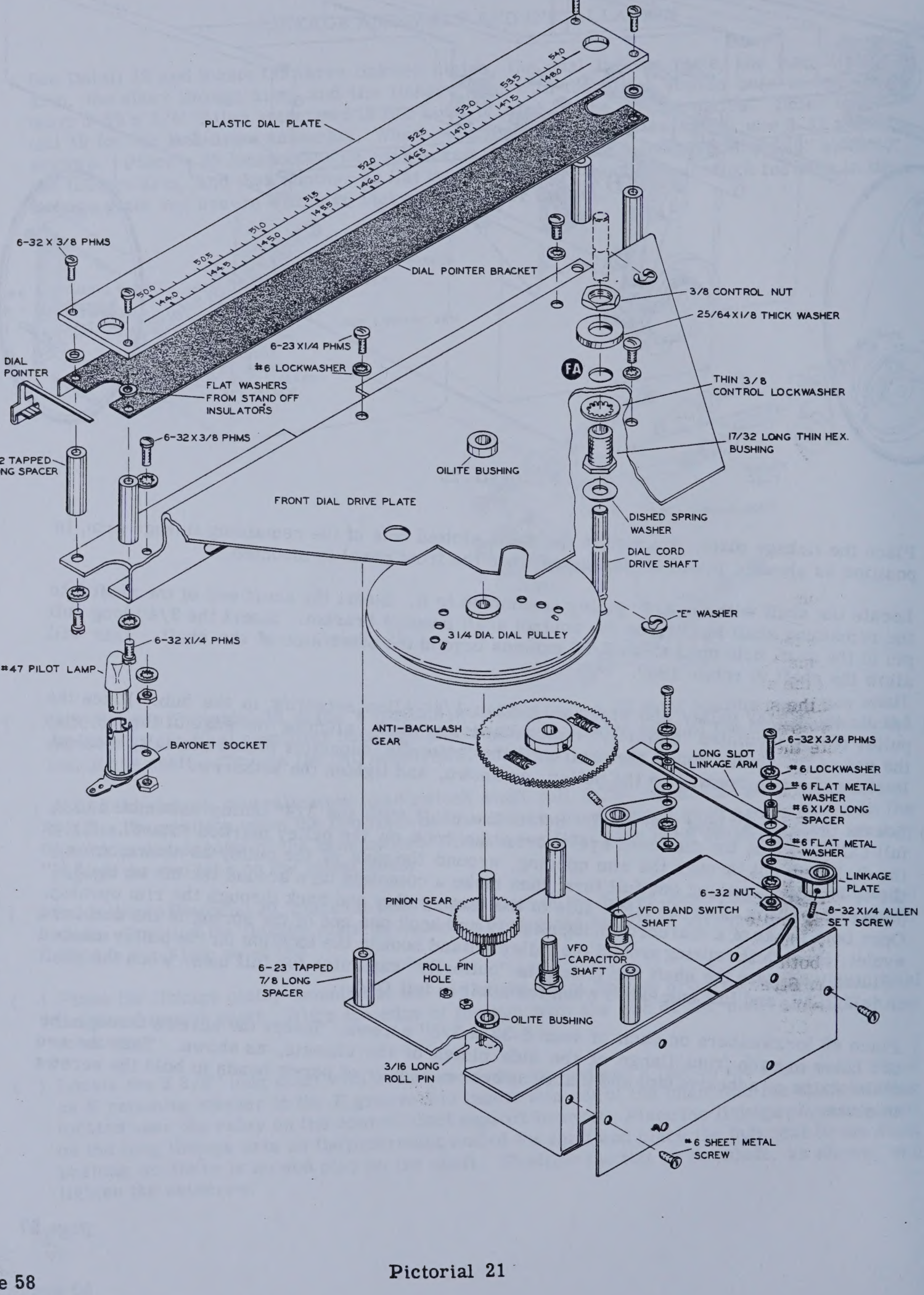
( ) Place the linkage plate, mounted in the short slotted hole of the remaining linkage arm, in position as shown. It will be connected when the front panel is mounted.

( ) Locate the shaft with the 3/4" pulley assembled to it. Insert the short end of the shaft into the remaining shaft bushing on the control shaft support bracket. Insert the 3/4" long roll pin in the shaft hole until about 3/8" extends beyond the other side of the shaft. This will allow the shaft to rotate 180°.

( ) Locate the 1 3/4" pulley and start an 8-32 x 1/4" Allen setscrew in the hub. Place the pulley on the insulated "butterfly" tuning capacitor shaft, aligning the edge of the hub with the end of the shaft. Rotate the shaft until the "butterfly" capacitor plates are fully meshed. Position the rim opening on the pulley, as shown, and tighten the setscrew.

( ) Locate the 14 3/4" long dial cord. Rotate the shaft with the 3/4" pulley assembled to it, full CCW. Place the dial cord eyelet over the hook on the pulley marked "Start". String the dial cord out through the rim opening, around the side of the pulley as shown, over to the 3/4" pulley, making one full turn, then make a complete turn around the tab on the 3/4" pulley, then back up to the other side of the large pulley and back through the rim opening. Open both hooks of a dial cord spring slightly and hook one end of the spring in the dial cord eyelet. Stretch the spring around the pulley hub and hook to the location on the pulley marked "Finish". Rotate the shaft and check the "butterfly" capacitor for full mesh when the shaft is full CCW, and full unmeshed when the shaft is full CW.

( ) Place #8 lockwashers on each of four 8-32 x 3/8" screws. Insert the screws through the two holes in each front flange of the side plates of the chassis, as shown. Take the two plain strips of adhesive tape and place one over each pair of screw heads to hold the screws in place.



PLASTIC DIAL PLATE
500
505
510
515
520
525
530
535
540
1440
1445
1450
1455
1460
1465
1470
1475
1480
6-32 X 3/8 PHMS
DIAL POINTER BRACKET
3/8 CONTROL NUT
25/64 X1/8 THICK WASHER
6-23 X1/4 PHMS
#6 LOCKWASHER
FA
DIAL POINTER
FLAT WASHERS FROM STAND OFF INSULATORS
THIN 3/8 CONTROL LOCKWASHER
6-32 X 3/8 PHMS
17/32 LONG THIN HEX. BUSHING
6-32 TAPPED 1" LONG SPACER
OILITE BUSHING
FRONT DIAL DRIVE PLATE
DISHED SPRING WASHER
DIAL CORD DRIVE SHAFT
"E" WASHER
3 1/4 DIA. DIAL PULLEY
6-32 X1/4 PHMS
#47 PILOT LAMP
ANTI-BACKLASH GEAR
6-32 X 3/8 PHMS
BAYONET SOCKET
LONG SLOT LINKAGE ARM
#6 LOCKWASHER
#6 FLAT METAL WASHER
#6 X1/8 LONG SPACER
#6 FLAT METAL WASHER
LINKAGE PLATE
PINION GEAR
6-32 NUT
VFO BAND SWITCH SHAFT
8-32 X1/4 ALLEN SET SCREW
6-23 TAPPED 7/8 LONG SPACER
ROLL PIN HOLE
VFO CAPACITOR SHAFT
OILITE BUSHING
3/16 LONG ROLL PIN
#6 SHEET METAL SCREW

Pictorial 21

VFO ASSEMBLY TO FRONT DIAL DRIVE PLATE

( ) Loosen the two 3/8" control nuts on the back dial drive plate and VFO subassembly. See Pictorial 21.

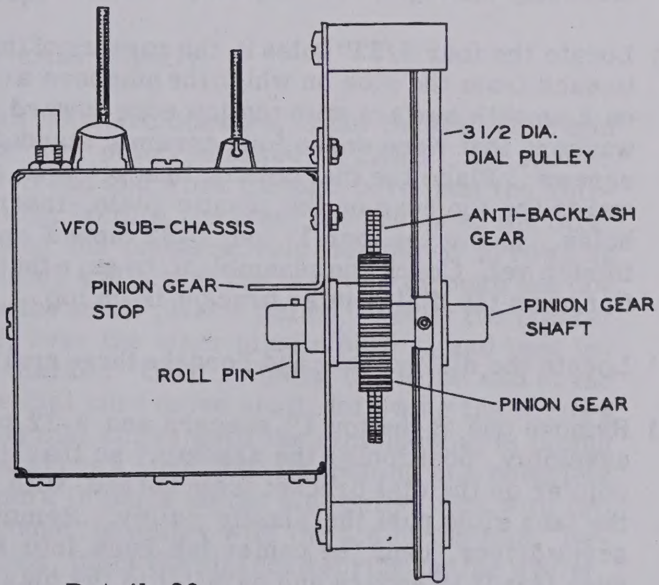
( ) Locate the dial drive pinion gear shaft with the small brass gear assembled to it. You will notice that there is a small roll pin hole in one end of the shaft. Insert this end into the Oilite bushing and then insert the 7/16" long roll pin into the shaft with about 3/16" extending out on one side. Rotate the pinion gear shaft so that the roll pin strikes the cam on the stop bracket.

( ) Locate the anti-backlash gear and mount temporarily on the VFO capacitor shaft with the hub up. Slide the dial drive plate so that the two gears completely mesh and then tighten the VFO band switch control nut. Remove the anti-backlash gear and tighten the VFO capacitor control nut, making certain that the dial drive plate is parallel on the VFO subassembly.

( ) Place tension on the anti-backlash gear by rotating one half of the gear past the other for a distance of two teeth. Hold the tension with a screwdriver or with your fingers and remount the gear on the VFO capacitor shaft, making sure the two gears mesh. Do not fasten the gear to the shaft yet.

( ) Looking at the gear side of the dial drive plate, rotate the pinion gear shaft in a counterclockwise direction until the roll pin rests against the stop. You will notice that there is about 1/8" of the VFO capacitor shaft extending beyond the anti-backlash gear. Using a pair of pliers, rotate the VFO capacitor just a few degrees, starting with the capacitor plates fully meshed, in a counterclockwise direction until there is about 1/8" difference at the ends of the rotor and stator plates. Tighten the anti-backlash gear to the VFO capacitor shaft, using an 8-32 x 1/4" Allen setscrew. Now rotate the pinion gear in a clockwise direction until it stops and observe that the capacitor plates are still meshed about 1/8" at the ends. The reason for not allowing the VFO capacitor to rotate a full 180^{o} is to prevent "capacity end effect".

( ) Rotate the pinion gear shaft until the roll pin is perpendicular to the stop, or the VFO capacitor is half meshed. Locate the large 3 1/2" dial pulley and mount on the pinion gear shaft with the hub toward the gear. Slide the dial pulley on the shaft until there is 1/4" of shaft protruding beyond the staked side of the hub. Rotate until the opening on the rim of the pulley is opposite to the anti-backlash gear and tighten to the shaft, using an 8-32 x 1/4" Allen setscrew. See Detail 20.



Detail 20

( ) Locate the linkage arm with the long slot. Refer to Pictorial 21 for assembly.

( ) Rotate the VFO band switch to the extreme counterclockwise position.

( ) Mount the linkage plate assembly on the VFO band switch, with the hub toward the dial drive plate, as shown. Align the linkage plate so that the flat on the band switch shaft faces the linkage arm and secure with an 8-32 x 1/4" Allen setscrew.

( ) Locate the 17/32" long shaft bushing with the thin hex flange. Slip a thin 3/8" control lockwasher on the bushing and mount on the front dial drive plate, inserting from the same side as the Oilite bushing at location FA. Slip a 25/64" x 1/8" thick washer on the bushing and secure temporarily with a 3/8" control nut.

( ) Locate the dial cord drive shaft. This is the 1 3/8" long shaft with two E washer grooves and a dial cord groove on one end. Mount an E washer in the groove near the dial cord groove. Slip the dished spring brass washer on the shaft and insert the shaft in the shaft bushing just installed. Insert from the end, as shown. Mount a second E washer on the other end of the shaft. It may be necessary to press the shaft against the spring brass washer in order to slip the E washer in place.

( ) Mount the back dial drive plate to the front dial drive plate, inserting the pinion gear shaft in the Oilite bushing mounted on the front dial drive plate. Align the three 7/8" long spacers with the three 5/32" holes in the front plate and fasten the two units together, using 6-32 x 1/4" screws with #6 lockwashers under the screw heads. It may be necessary to loosen the screws on the backplate holding the spacers, in order to get proper alignment. Tighten all screws when proper alignment has been obtained.

( ) Locate the VFO bottom shield and mount on the VFO subassembly, using six #6 sheet metal screws.

( ) Mount two 6-32 x 3/8" screws in the two 5/32" holes located near the large slots at each end of the flange of the front dial plate. Use #6 lockwashers under the screw heads and secure with #6 lockwashers under the nuts, as shown. These are used for mounting of the pilot lamp bayonet socket.

( ) Locate the plastic dial plate and the dial pointer bracket. Handle the plastic plate by its edges to avoid finger smudges and remove the paper backing. Using a solution of a few drops of household detergent (Joy, Liquid Lux, etc.) in a cup of lukewarm water, wipe over both sides of the plastic plate with a sponge or soft cloth. This will prevent static charges from collecting on the plastic that normally attracts dust particles, and will also clean any smudges that may be present.

( ) Locate the four 5/32" holes in the corners of the plastic plate and insert a 6-32 x 3/8" screw in each from the side on which the numbers are legible. Laying the plastic plate front down on a smooth surface with the top edge toward you will ease assembly. Locate the four flat washers that were on the four ceramic standoff insulators and place one on each of the four screws. Place the dial pointer bracket with the black painted side down and the flange towards the top edge on the plastic plate, inserting the screws through the matching 5/32" holes. Mount the four 1" long 6-32 tapped spacers on the four protruding screws. Do not tighten yet. Check the assembly to be sure that the numbered scales are legible and that the flange on the dial pointer bracket is on top.

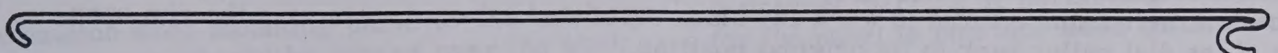
( ) Locate the dial pointer and bend the three small tabs perpendicular to the "U" shaped flange.

( ) Remove one of the top 1" spacers and 6-32 x 3/8" screws just installed on the dial plate assembly, positioning the assembly so that the flat washer remains in place. Slip the dial pointer on the dial bracket from the end, with the pointer flush against the plastic plate so that the tabs slide past the plastic pulley. Remount the 1" spacer and screw. Using a small screwdriver, bend the center tab back into its original position. Check the pointer to be sure that it is square and parallel to the plastic plate.

( ) Place the dial pointer bracket assembly in position on the front dial drive plate, matching the four 1" long spacers with the four 5/32" holes in the back flange. Secure with four 6-32 x 1/4" screws with #6 lockwashers under the screw heads. Now tighten the four front screws.

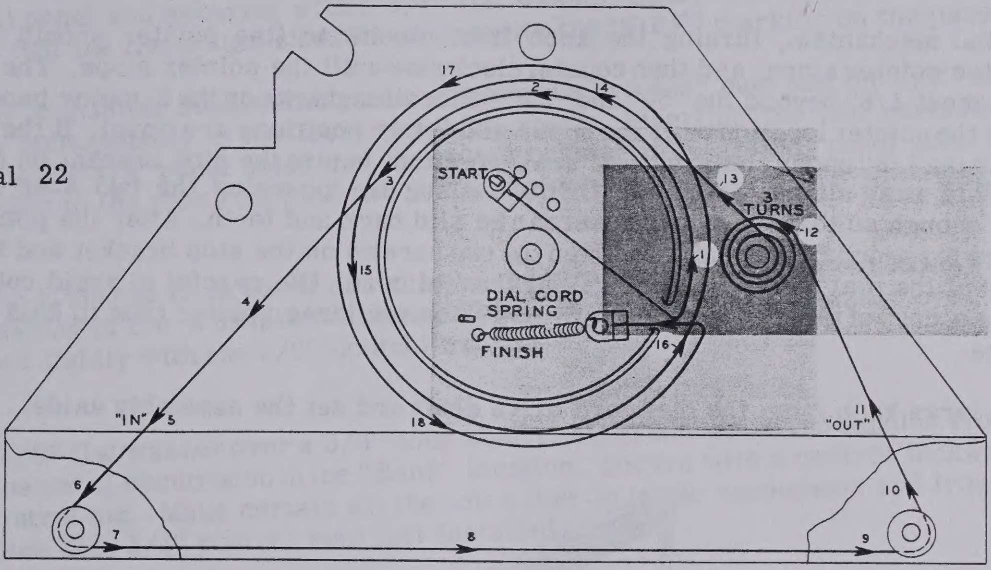
( ) Locate the two bayonet sockets and #47 pilot lights and install the lights in the sockets. Mount the sockets on the back of the flange of the dial drive plate, inserting the pilot lights in the large plastic dial plate holes, as shown. Slip the socket brackets over the screws previously mounted and secure with 6-32 nuts.

( ) Cut a #16 wire to 6" in length. Form a hook at each end as shown in Detail 21. This tool will be used as an aid in stringing the dial cord.



Detail 21

( ) Locate the 50 1/2" length of dial cord. Study Pictorial 22 first and observe how the dial pointer dial drive cord is strung.



Pictorial 22

( ) Position the VFO-dial drive plate assembly upside down with the VFO subassembly toward you. Use an empty box or tube carton for a prop.

( ) Locate a dial cord spring and open up both end hooks slightly.

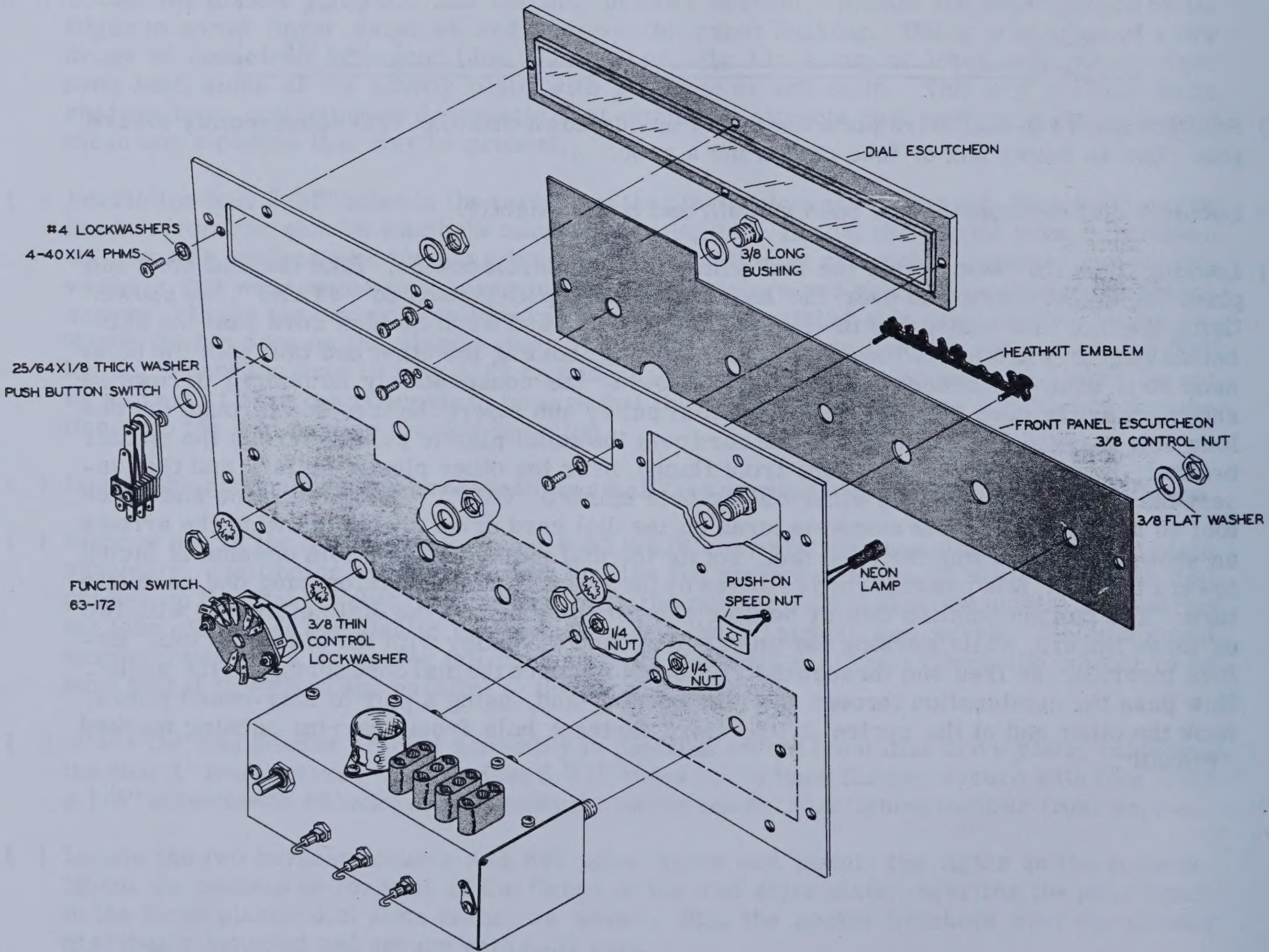
( ) Looking from the back, rotate the dial pulley full counterclockwise. Take the dial cord and place the eyelet of one end over the hook on the dial pulley marked "START", as shown. Using the tool just made, use the inverted hooked end and work the dial cord past the anti-backlash gear hub and out through the rim opening, holding the other end taut with the other hand so it does not become unhooked. Following the consecutively numbered arrows as shown, pass the cord over the rim of the dial pulley and insert the free end through the oblong hole marked "IN". Then pass the cord over the small plastic pulley, across the pointer bracket, laying the cord behind the front flange, over the other plastic pulley, and then insert the free end through the other oblong hole marked "OUT". Using the same end of the tool as an aid, make three complete turns on the dial cord drive shaft, following the arrows as shown. Still keeping the cord taut, rotate the dial pulley until the rim opening is facing toward the left. Now pass the cord as shown by the arrows, past the rim opening one complete turn. You can accomplish this by holding the cord in place on the dial pulley rim with two or three fingers, while working the other end around the pulley with the aid of the tool. Before inserting the free end through the rim opening, place the dial cord spring on the eyelet. Now pass the combination through the rim opening and, using a pair of long-nosed pliers, hook the other end of the spring in the third farthest hole from the rim opening marked "FINISH".

( ) Temporarily place the large 2 1/2" knob on the dial drive shaft, starting two 8-32 x 1/4" Allen setscrews in the knob. Tighten one of the setscrews and rotate the dial mechanism two or three complete turns to work any slack out of the dial cord, returning the rim opening of the dial pulley back to its original position.

( ) Move the dial pointer to the center of the dial plate. Reaching through the cutout opening, slip the dial cord between the center tab and the two end tabs on the bottom of the pointer. Using a screwdriver, bend the two end tabs against the dial cord just enough so that the dial pointer will move when the dial mechanism is rotated.

( ) Rotate the dial mechanism, turning the knob first clockwise (the pointer should move up scale) until the pointer stops, and then counterclockwise until the pointer stops. The pointer should stop about 1/8" beyond the "50" and "54" calibration marks on the 6-meter band scale. First adjust the pointer location until the upper and lower positions are equal. If the pointer fails to reach the 1/8" upper and lower off scale positions, move the stop bracket on the back dial drive plate away slightly from the Oilite bushing by loosening the two 4-40 screws. Loosen just enough so that the stop bracket can be slid back and forth. After the pointer has been adjusted for proper positioning, tighten the two screws on the stop bracket and bend the two end tabs of the dial pointer tightly against the dial cord. (Be careful to avoid cutting the cord.) Place a drop of glue, cement, or nail polish on the three pointer tabs to hold the dial cord in place.

( ) Remove the large knob from the dial cord drive shaft and set the assembly aside.


DIAL ESCUTCHEON
#4 LOCKWASHERS
4-40X1/4 PHMS
3/8 LONG BUSHING
HEATHKIT EMBLEM
25/64X1/8 THICK WASHER
PUSH BUTTON SWITCH
FRONT PANEL ESCUTCHEON
3/8 CONTROL NUT
3/8 FLAT WASHER
NEON LAMP
PUSH-ON SPEED NUT
FUNCTION SWITCH 63-172
3/8 THIN CONTROL LOCKWASHER
1/4 NUT
1/4 NUT

Pictorial 23

FRONT PANEL ASSEMBLY

Use caution when mounting parts to the front panel to prevent marring or scratching. A soft cloth or paper should be placed over the work area for the panel is laid face down quite often for some of the following steps.

( ) Locate the function switch (#63-172) and turn full counterclockwise, then mount at the "Function" location, as shown in Pictorial 23, using a 3/8" thin control lockwasher between the switch and panel and securing with a 3/8" flat washer under the control nut. Position the switch so that the flat on the shaft faces opposite the "OFF" marking on the panel.

( ) Locate the multiplier subassembly and remove the two 1/4" nuts and the 3/8" control nut. Mount the subassembly to the front panel as shown, inserting the two variable capacitor bushings in the 1/4" panel holes and the switch bushing in the 25/64" panel hole. Secure the subassembly to the panel with the two 1/4" nuts only.

( ) Locate the L shaped front panel escutcheon and slip the location marked Xtal-VFO over the switch bushing of the multiplier subassembly. Place a 3/8" flat washer over the bushing and secure lightly with the 3/8" control nut.

( ) Place a 3/8" flat washer over a 3/8" long shaft bushing and insert the bushing from the front side of the panel escutcheon in the "Band" location. Secure with a control lockwasher under a 3/8" control nut. Make certain all the holes line up in the escutcheon and front panel, and then tighten both 3/8" control nuts just installed.

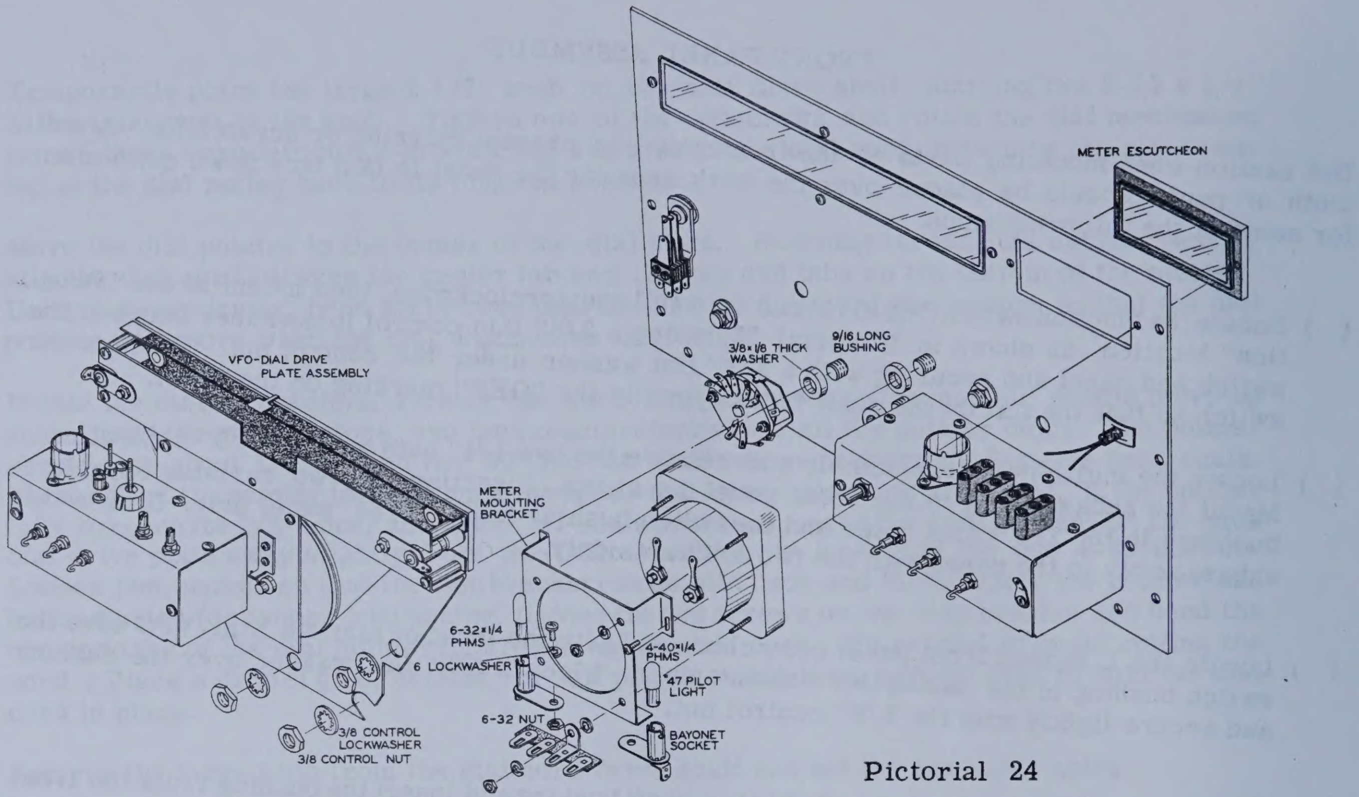
( ) Install a second 3/8" long shaft bushing in the same manner as above at the "Coupling" location.

( ) Locate the push button switch and install at the "Spotting" location, using a 25/64" x 1/8" thick washer between the switch and front panel and secure with the flat nickel washer and nut supplied with the switch.

( ) Locate the neon lamp with the red plastic flat lens with leads connected and install in the 5/16" hole near the "Meter" location. Insert from the front of the panel and secure with the push-on speed nut.

( ) Place the Heathkit nameplate in position in the two small holes provided in the panel above the meter and coupling locations. Clip the plastic studs to within 1/8" of the back of the panel and secure the nameplate by touching the studs with a hot iron to form a retaining shoulder of plastic on the stud.

( ) Mount the long dial escutcheon on the front of the panel in the long narrow rectangular hole. Secure with four 4-40 x 1/4" screws with #4 lockwashers under the screw heads. Use care in this and succeeding steps not to crack the glass in the escutcheon.


METER ESCUTCHEON
3/8×1/8 THICK WASHER
9/16 LONG BUSHING
VFO-DIAL DRIVE PLATE ASSEMBLY
METER MOUNTING BRACKET
6-32×1/4 PHMS
6 LOCKWASHER
4-40×1/4 PHMS
47 PILOT LIGHT
6-32 NUT
BAYONET SOCKET
3/8 CONTROL LOCKWASHER
3/8 CONTROL NUT

Pictorial 24

( ) Locate the meter mounting bracket, the meter, and two bayonet pilot light sockets. Slip #6 lockwashers on each of two 6-32 x 1/4" screws and insert the screws in the two 5/32" holes in the bottom flange of the bracket from the side as shown in Pictorial 24. Now mount the bayonet sockets on each side of the bracket, using these screws, and secure with 6-32 nuts.

( ) Mount the meter on the bracket with the face between the flanges and the bottom of the meter towards the bayonet sockets. Mount a 4-lug terminal strip on the bottom right hand screw stud, using the hardware supplied with the meter. Position the terminal strip as shown. Remove the shorting wire across the meter terminals.

( ) Bend the lugs on the bayonet sockets down at right angles.

( ) Check the meter for zero reading and if necessary, adjust to read zero by turning the plastic screw on the face of the meter.

( ) Place the meter escutcheon in place on the front side of the panel in the smaller rectangular hole. Place the meter bracket assembly in place on the back side of the panel, and using 4-40 x 1/4" screws (no lockwashers used here) secure the bracket and escutcheon to the panel by passing the mounting screws through the slotted holes in the bracket flanges, through the panel holes and into the tapped holes in the escutcheon.

( ) Install two #47 pilot lights in the bayonet sockets on the meter bracket.

( ) Locate the three 9/16" long shaft bushings and place a flat washer on each. Insert the bushings from the front of the panel at hole locations marked "Loading", "Drive" and "Final". Place a 25/64" x 1/8" thick washer on each of the bushings. Using a small tube carton as a prop under the multiplier subassembly, place the front panel on edge.

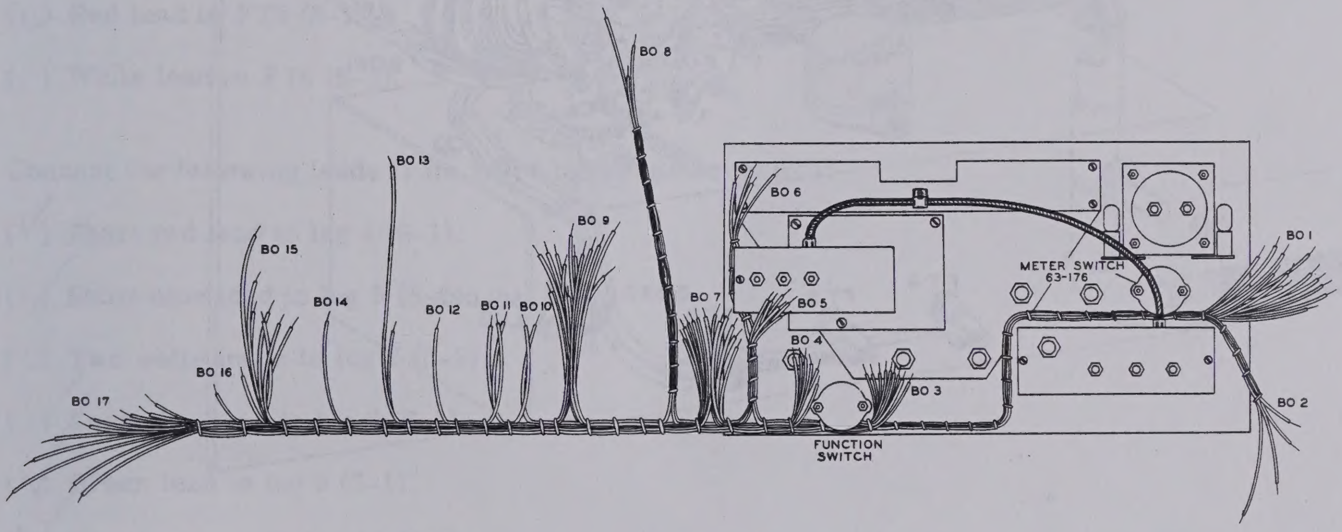
( ) Take the VFO-front dial drive plate assembly and remove the E washer from the dial drive cord shaft and the 3/8" control nut from the bushing, leaving the 25/64" x 1/8" thick washer in place.

( ) Mount the VFO-front dial drive plate assembly to the front panel as shown, inserting the dial drive shaft bushing through the panel hole location marked "Frequency", and matching up the other three holes with the long bushings just installed. Place a 3/8" control lockwasher over each bushing on the back of the assembly and start a 3/8" control nut on each.

( ) Place a flat washer over the dial drive shaft bushing and start a 3/8" control nut on the front of the panel. Position the VFO dial drive plate assembly so that the calibration scales are parallel in the escutcheon window. Now tighten all four control nuts.

( ) If there is still some end play on the dial drive shaft, a spare dished spring washer is included with the kit. Slip it on the shaft and replace the E washer. Using a screwdriver as a lever arm against the rear end of the shaft and forcing it forward will aid in slipping the E washer in place.

This completes the front panel assembly.



Pictorial 25

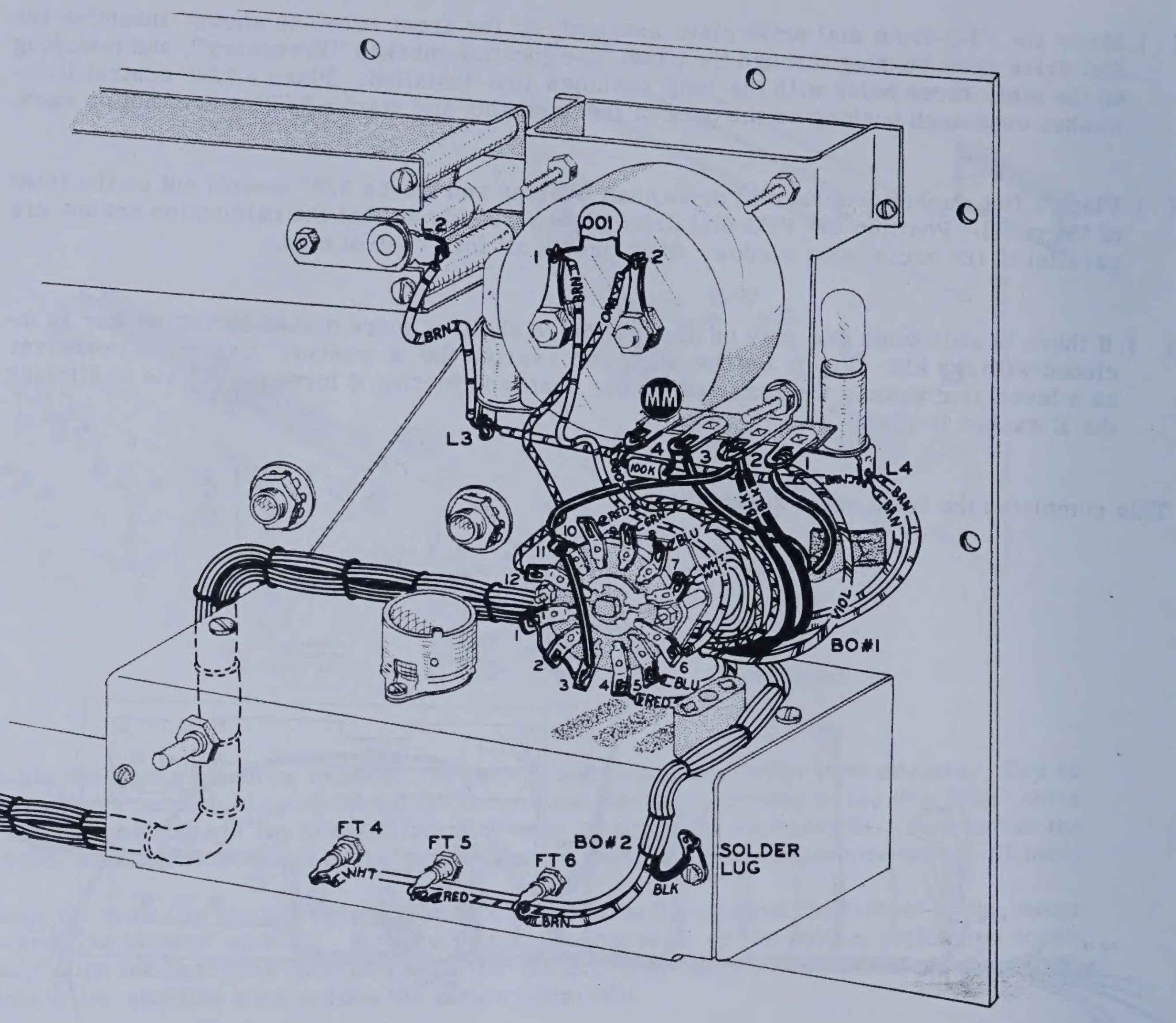
WIRING OF THE CABLE ASSEMBLY TO THE FRONT PANEL

(✓) Lay the panel face down for the following connections. See Pictorial 26 on page 66.

(✓) Cut two lengths of sleeving to 1 1/2" and slip over each lead from the neon lamp. Connect one lead to lug 1 (NS) and the other lead to lug 3 (NS) of terminal strip MM.

(✓) Cut a brown hookup wire to 4" in length and strip both ends 1/4". Connect one end to pilot light socket L2 (S-1). Connect the other end to pilot light socket L3 (NS).

(✓) Cut a brown hookup wire to 4 1/4" in length and strip both ends 1/4". Connect one end to pilot light socket L3 (S-2). Connect the other end to pilot light socket L4 (NS).


L2
001
1
2
BRN
MM
L3
4
3
2
1
L4
HOOK
RED
GRN
BLU
WHT
BLK
BRN
10
11
12
9
8
7
6
5
4
3
2
1
BLU
RED
BO#1
FT 4
FT 5
FT 6
BO#2
SOLDER LUG
WHT
RED
BRN
BLK

Pictorial 26

(✓) Cut both leads of a 100 KΩ resistor (brown-black-yellow) to 1/2" in length. Connect one lead to lug 3 (S-2) of terminal strip MM. Connect the other lead to lug 4 (NS) of terminal strip MM.

(✓) Locate the cable assembly and study Pictorials 25, 26 and 27. With BO #1 and BO #2 of the cable assembly to your right, place the cable assembly on top of the multiplier sub-chassis and flat against the panel. Straddle the function switch with BO #3 and BO #4.

(✓) Now mount the meter switch (#63-176) to the front panel at the locations marked "Meter". Use a 3/8" thin control lockwasher between the switch and panel, and secure with a flat washer under a 3/8" control nut. Position the switch so that the flat on the shaft is opposite the "GRD 1" marking on the panel with the switch in its extreme CCW position. The cable assembly will be between the wafer on the switch and the panel as shown.

( ) Cut a brown hookup wire to 6" in length and strip both ends 1/4". Connect one end to lug 6 of the meter switch (S-1). Dress the wire as shown and connect the other end to lug 1 on the meter (NS).

(✓) Cut an orange hookup wire to 6 1/2" in length and strip both ends 1/4". Connect one end to lug 12 of the meter switch (S-1). Connect the other end to lug 2 on the meter (NS).

(✓) Cut both leads of a .001 mmf disc ceramic capacitor to 3/4" in length. Connect one lead to lug 1 (S-2) and connect the other lead to lug 2 (S-2) on the meter.

(✓) Cut a bare wire to 6" in length. Feed one end through lug 11 on the meter switch, slip a 1" length of sleeving over the wire, then feed through lug 3, then lug 2, and connect to lug 1. Solder the four lugs. Slip a 3 1/4" length of sleeving over the other end, dress the lead as shown and connect to lug 2 of terminal strip MM (NS).

Connect the following leads from BO#2 to the multiplier subchassis:

(✓) Black lead to the solder lug (S-1).

(✓) Brown lead to FT6 (S-1).

(✓) Red lead to FT5 (S-1).

(✓) White lead to FT4 (S-1).

Connect the following leads from BO#1 to the meter switch:

(✓) Short red lead to lug 4 (S-1).

(✓) Short blue lead to lug 5 (S-1).

(✓) Two white leads to lug 7 (S-2).

(✓) Long blue lead to lug 8 (S-1).

(✓) Green lead to lug 9 (S-1).

(✓) Long red lead to lug 10 (S-1).

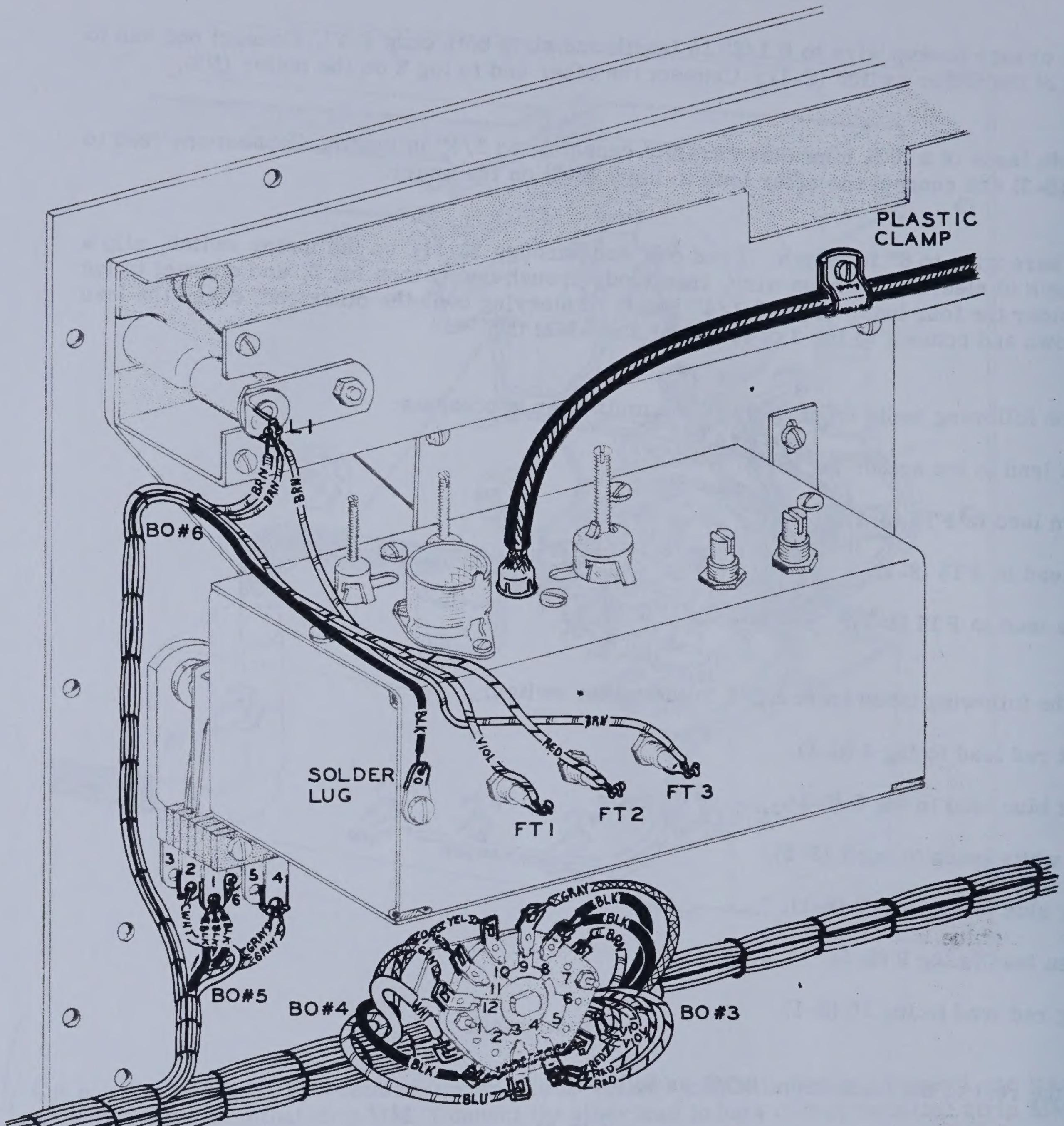
Connect the rest of the leads from BO#1 as follows:

(✓) Two brown leads to the pilot light socket L4 (S-3).

( ) Two black leads to lug 2 of terminal strip MM (S-3).

( ) Orange lead to lug 4 of terminal strip MM (S-2).

( ) Violet lead to lug 1 of terminal strip MM (S-2).


PLASTIC CLAMP
L1
BRN
BRN
BRN
BO#6
BLK
VIOL
RED
BRN
SOLDER LUG
FT1
FT2
FT3
3
2
1
6
5
4
WHT
BLK
BLK
GRAY
GRAY
BO#5
BO#4
BO#3
YEL
GRAY
BLK
BLK
BRN
WHT
BLK
BLU
RED
RED
RED
VIOL
VIOL
1
2
3
4
5
6
7
8
9
10
11
12

Pictorial 27

(✓) Cut a bare wire to 1 1/4" in length. Feed one end through lug 2 of the function switch, slip a 7/8" length of sleeving over the wire and connect to lug 5 (S-1). Do not solder lug 2. See Pictorial 27.

(✓) Cut a brown hookup wire to 6" in length and strip both ends 1/4". Connect one end to FT3 (S-1), dress the lead as shown, and connect the other end to pilot light socket L1 (NS).

Connect the following leads from BO#3 to the function switch.

( ) Gray lead to lug 9 (S-1).

( ) Two black leads to lug 8 (S-2).

( ) Brown lead to lug 7 (S-1).

(✓) Two violet leads to lug 6 (S-2).

(✓) Three red leads to lug 4 (S-3).

Connect the following leads from BO#4 to the function switch:

(✓) Yellow lead to lug 10 (S-1).

(✓) Orange lead to lug 11 (S-1).

( ) Green lead to lug 12 (S-1).

(✓) Heavy white lead to lug 1 (S-1).

( ) Heavy black lead to lug 2 (S-2).

(✓) Blue lead to lug 3 (S-1).

(✓) Connect a bare wire from lug 6 (S-1) to lug 1 (NS) of the spotting push button switch. Dress the cable harness with BO#5 and BO#6 to the panel and close to the spotting push button switch, as shown.

Connect the following leads from BO#5 to the spotting push button switch:

(✓) Two gray leads to lug 4 (S-2).

(✓) White lead to lug 2 (S-1).

(✓) Three black leads to lug 1 (S-4).

Dress the leads from BO#6 as shown and connect as follows:

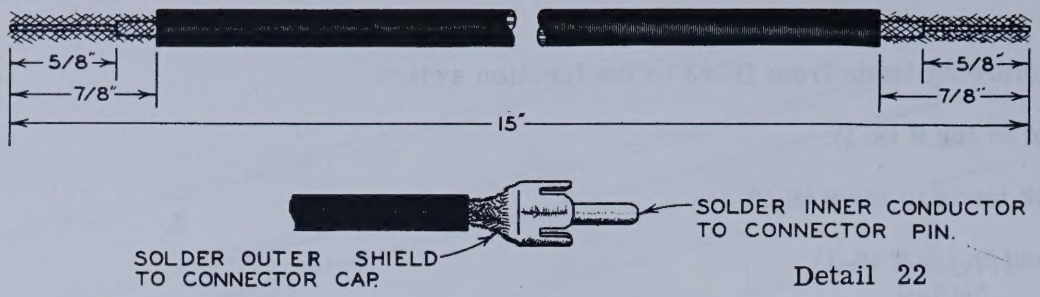
(✓) #18 heavy brown lead to pilot light socket L1 (NS).

(✓) Brown lead to pilot light socket L1 (S-3).

(✓) Black lead to the solder lug on the VFO subchassis (S-1).

(✓) Violet lead to FT1 (S-1).

(✓) Red lead to FT2 (S-1).


5/8"
7/8"
15"
5/8"
7/8"
SOLDER INNER CONDUCTOR TO CONNECTOR PIN.
SOLDER OUTER SHIELD TO CONNECTOR CAP.

Detail 22

(✓) Locate the long coaxial cable and cut a piece to a length of 15". Strip the outer jacket off of both ends for a distance of 7/8", as shown in Detail 22. Push the shield back on both ends and strip the inner conductors to 5/8".

(✓) Install a phono connector on both ends of the coaxial cable. Insert the inner conductor in the phono connector and solder the tip. Then slip the shield over the connector cap and solder.

(✓) Prepare the ends of a second coaxial cable, cut to a length of 4 1/2", the same as above. Also install a phono connector on each end of this cable, then set the shorter cable aside temporarily.

(✓) Plug one end of the longer cable in the phono socket located on top of the multiplier subchassis. Make sure there is clearance between the phono connector and the lugs on the meter switch. Plug the other end in the phono socket on the VFO subchassis, as shown in Pictorials 25 and 27. Take the plastic clamp, slip it over the cable, and mount the clamp to the rear flange of the dial drive plate, using a 6-32 x 3/8" screw. Secure, using a #6 lockwasher under the nut. Dress the cable as shown.

(✓) Install the 6AN8 tube in its socket (V2) on the multiplier subchassis. Then install the 2" tube shield over the tube.

(✓) Also install the 6AU6 tube in its socket (V1) on the VFO subchassis along with a 1 3/4" tube shield.

This completes the wiring to the front panel.

MOUNTING THE FRONT PANEL TO THE MAIN CHASSIS

( ) Position the chassis so that the power transformer and the final amplifier housing are near the edge of the work area. This is to provide clearance for the top of the panel when mounting. Be sure the linkage plate on the slotted linkage arm is in the position as shown in Pictorial 20 on page 57.

(✓) Now take the front panel and form the cable harness at right angles away from the front panel near the function switch. Position the cable so that it does not catch on the main chassis when mounting the front panel.

(✓) Position the front panel with the bottom edge up. Hold the linkage plate on the VFO linkage arm in line with the bushing located at the "Band" location. Now slip the panel in place, inserting the shafts through the mating shaft bushings with the band switch shaft going through the linkage plate first, then through the front panel bushing. Before pushing the panel completely in position, place the linkage plate from the short slotted linkage arm on the multiplier band switch shaft.

(✓) Check the band switch shaft and final tuning shaft to be sure they line up with the front panel bushings. If not, remove the front panel and loosen the two 6-32 screws holding the control shaft support bracket in place. Position the bracket until the shafts line up. Then remount the panel.

(✓) Now push the panel in position so that the four 8-32 screws previously installed in the end flanges of the chassis protrude through the four 3/16" holes in the panel. Place a #8 flat metal washer on each of the four screws and temporarily secure the panel to the chassis with the four 8-32 hex cap nuts.

( ) Locate the two 1 3/4" diameter knobs and start two 8-32 x 1/4" Allen setscrews in each knob. Install the knobs temporarily on the band switch shaft and the final tuning shaft. Rotate both knobs and if the shafts bind in the bushings, remove the front panel and loosen the two 6-32 screws holding the control shaft support bracket in place. Position the bracket until the shafts rotate freely. Then secure the front panel in place.

( ) Dress the leads from BO#4 of the cable harness, close to the front panel near the function switch, so that the linkage plate and arm do not catch any of the leads when the band switch shaft is rotated.

( ) Replace the knob on the band switch shaft, positioning the setscrew opposite the knob pointer over the flat on the shaft. Tighten both setscrews. Rotate the band switch full CCW, then loosen the setscrew on the linkage plate connected to the long linkage arm. Rotate the knob until the pointer lines up with the "2M" marking. Now retighten the setscrew and rotate the band switch to the "6M" position and leave in this position for the following step.

( ) Position the other linkage plate on the band switch shaft so that the linkage arm is parallel to the front panel. With the edge of the slot in the linkage arm resting against the VFO linkage plate and making sure the VFO band switch is in the CCW position, tighten the setscrew. Now rotate the band switch knob back to the "2M" position for the next step.

( ) Make sure the multiplier band switch is in the 2-meter position, full CCW looking at the shaft end. Position the linkage plate in the center of the slot of the linkage arm and tighten the setscrew.

( ) Rotate the band switch knob a few times and check all switches, making sure they all change position properly, particularly the multiplier band switch.

( ) Locate the plain 3 1/8" long shaft and insert through the panel bushing marked "Loading". Insert into the flexible coupling until 3/8" extends out from the front panel. Tighten the two setscrews on the coupling.

( ) Dress the cable between the relay and the bottom flange of the chassis with BO#7 across the top of the relay, as shown in Pictorial 28 on page 72.

Connect the following leads from BO#7 to the relay:

NOTE: When soldering around the relay, use caution to prevent burning the insulation on other wires.

( ) Two orange leads to lug 7 (S-2).

( ) Two violet leads to lug 8 (S-2).

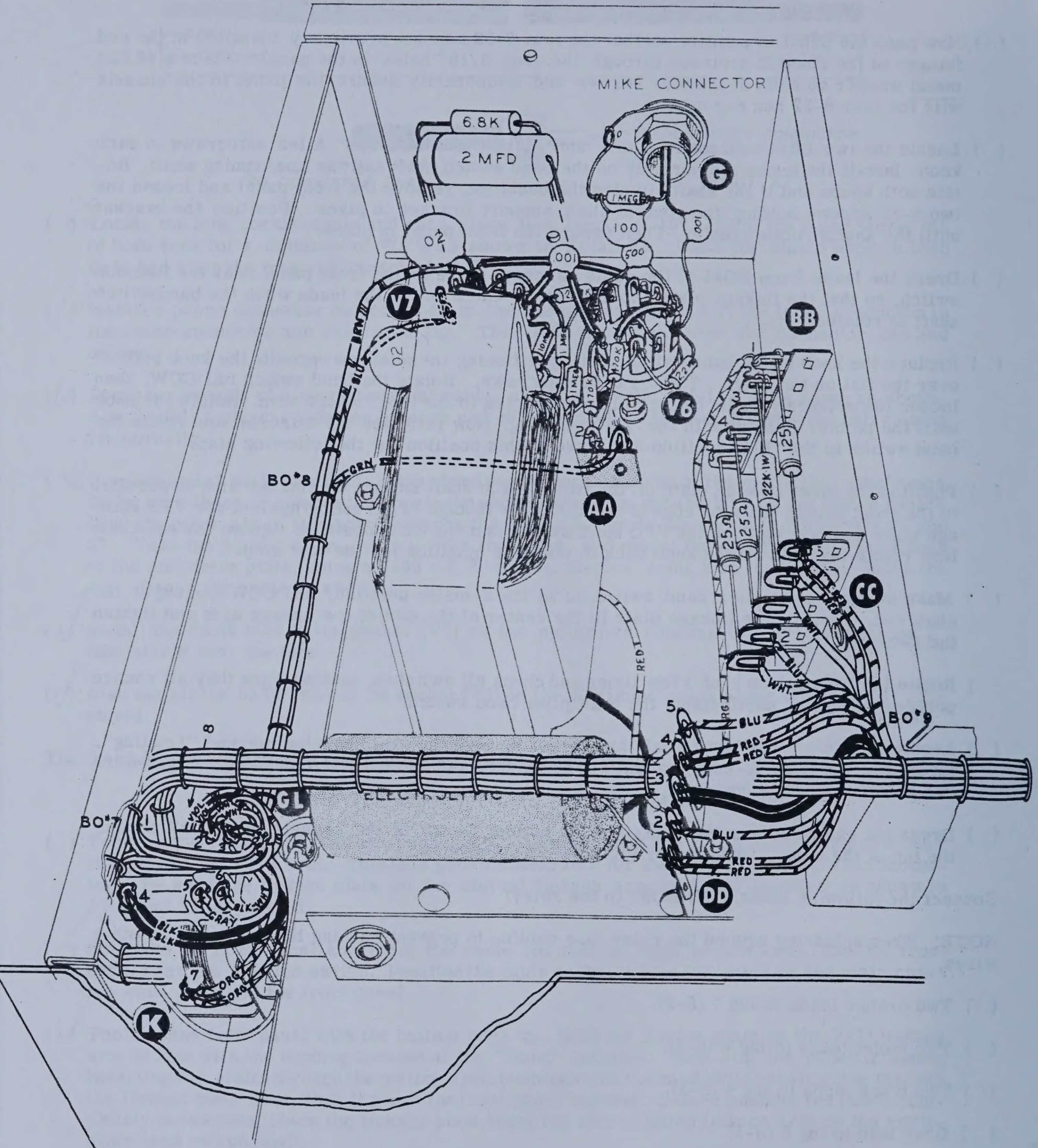
( ) Two black leads to lug 4 (S-3).

( ) Gray lead to lug 5 (S-1).

( ) White lead with black tracer to lug 6 (S-1).

( ) Two white leads to lug 2 (S-2).

( ) Two green leads to lug 3 (S-2).


MIKE CONNECTOR
6.8K
2 MFD
G
1 MEG
100
.001
.02
.001
500
V7
BRN
BLU
.02
10 MEG
1 MEG
12K
1 MEG
470K
470K
2.2K
V6
BB
3
4
125
22K-1W
25Ω
25Ω
BO#8
GRN
AA
5
CC
RED
WHT
2
BLU
WHT
RED
5
BLU
BO#9
4
RED
RED
8
3
ELECTROLYTIC
GL
BO#7
1
VIOL
WHT
2
2
BLU
1
RED
RED
DD
4
5
6
BLK
WHT
GRAY
BLK
BLK
7
ORG
ORG
K

Pictorial 28

Dress BO#8 along the chassis as shown, and connect as follows:

(✓) #18 heavy brown lead to pin 4 of V7 (S-3).

(✓) Blue lead to pin 1 of V7 (S-3).

(✓) Green lead to lug 1 of terminal strip AA (S-3).

Connect the following leads from BO#9 to terminal strip DD:

+ ( ) Two thin red leads to lug 1 (S-4).

(✓) Short blue lead to lug 2 (S-2).

(✓) Two black leads to lug 3 (S-2).

✗ ( ) Two long heavy red leads to lug 4 (S-4).

(✓) Long heavy blue lead to lug 5 (S-2).

Connect the remaining leads from BO#9 to terminal strip CC as follows:

(✓) Long white lead to lug 1 (S-2).

(✓) Long blue lead to lug 2 (S-3).

(✓) Short white lead to lug 4 (S-2).

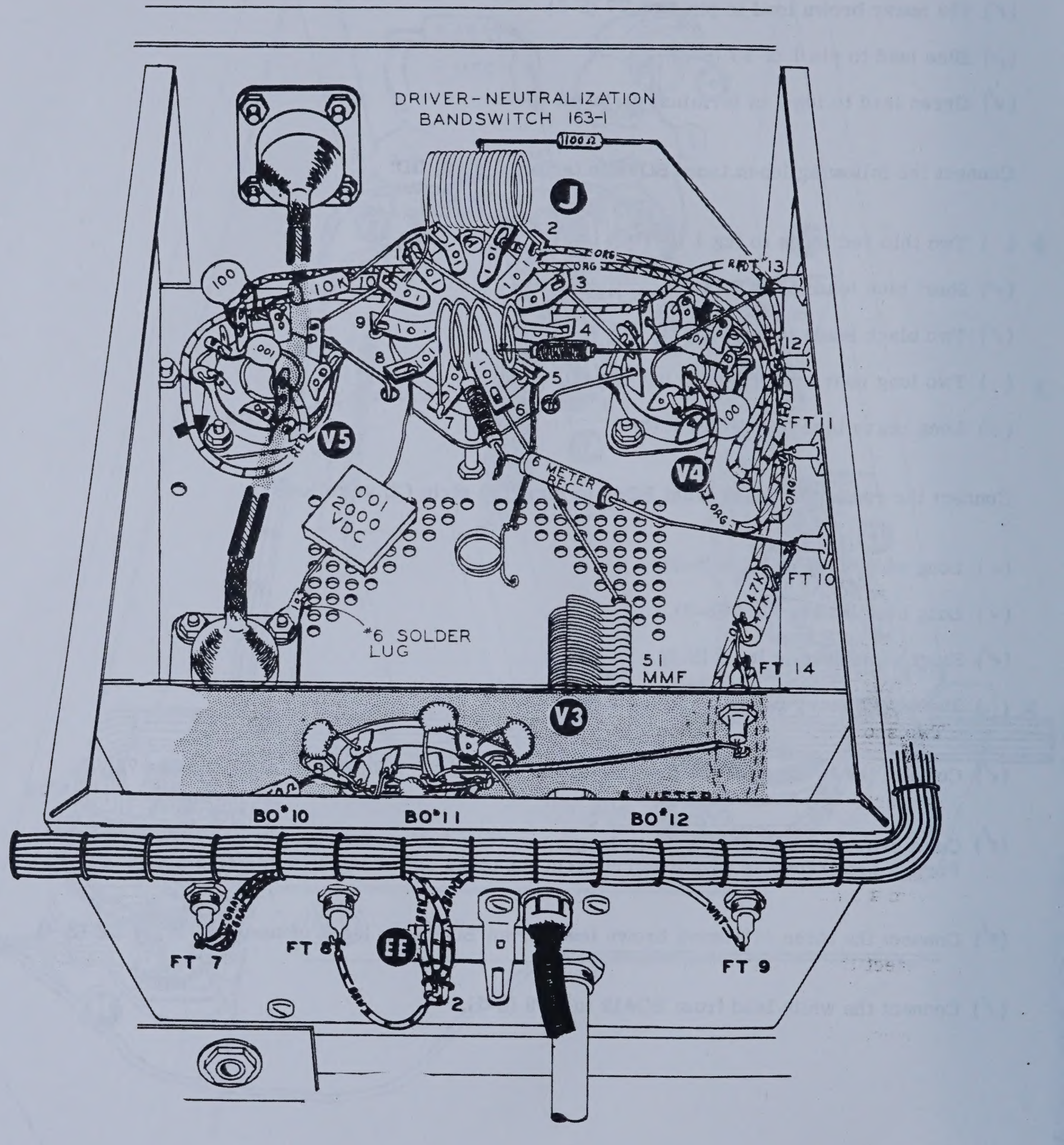
✗ ( ) Two short heavy red leads to lug 5 (S-3).

(✓) Connect the two gray leads from BO#10 to FT7 (S-2). See Pictorial 29 on page 74.

(✓) Cut a brown hookup wire to 1" in length and strip both ends. Connect one end to FT8 (S-1). Form a small loop as shown and connect the other end to lug 2 of terminal strip EE (NS).

(✓) Connect the three #18 heavy brown leads from BO#11 to lug 2 of terminal strip EE (S-4).

(✓) Connect the white lead from BO#12 to FT9 (S-1).


DRIVER-NEUTRALIZATION
BANDSWITCH 163-1
100Ω
J
1
2
3
4
5
6
7
8
9
10
12
13
ORG
ORG
RED
100
10K
.01
.001
V5
V4
V3
RED
FT 11
6 METER
RFC
.001
2000
VDC
ORG
47K
FT 10
*6 SOLDER
LUG
51
MMF
FT 14
BO*10
BO*11
BO*12
FT 7
FT 8
EE
2
FT 9
WHT

Pictorial 29

x ( ) Feed the heavy red lead from BO#13 through grommet B and connect to FT15 on the final amplifier housing (NS). See Pictorial 30 on page 76.

(✓) Connect the heavy blue lead from BO#13 to lug 1 of terminal strip FF (S-2).

(✓) Connect the black lead from BO#14 to the ground lug on filter capacitor EA (S-1).

Connect the following leads from BO#15:

+ ( ) Two thin red leads to FT10 (S-2).

( ) Short orange lead to FT11 (NS).

x ( ) Heavy red lead to the center lug on filter capacitor EB (NS).

Dress the white, gray and violet leads from BO#15 as shown and connect as follows:

○ ( ) White lead to lug 4 on terminal strip GG (S-3).

(✓) Gray lead to lug 2 on terminal strip GG (S-3).

( ) Violet lead to pin 5 of tube socket V10 (S-1).

○ ( ) Connect the #18 heavy brown lead from BO#16 to FT12 (S-3). The yellow lead will be connected later.

Connect the leads from BO#17 as follows:

○ ( ) Gray lead to lug 3 on the key jack (S-2).

( ) Green lead to lug 2 on terminal strip JJ (S-3).

(✓) Short blue lead to pin 8 of tube socket V11 (S-2).

( ) White lead with black tracer to pin 2 of accessory socket (S-2).

○ ( ) Brown lead to pin 4 of accessory socket (S-2).

( ) Orange lead to pin 5 of accessory socket (S-3).

( ) Violet lead to pin 6 of accessory socket (S-2).

( ) Heavy black lead to lug 1 of terminal strip KK (S-3).

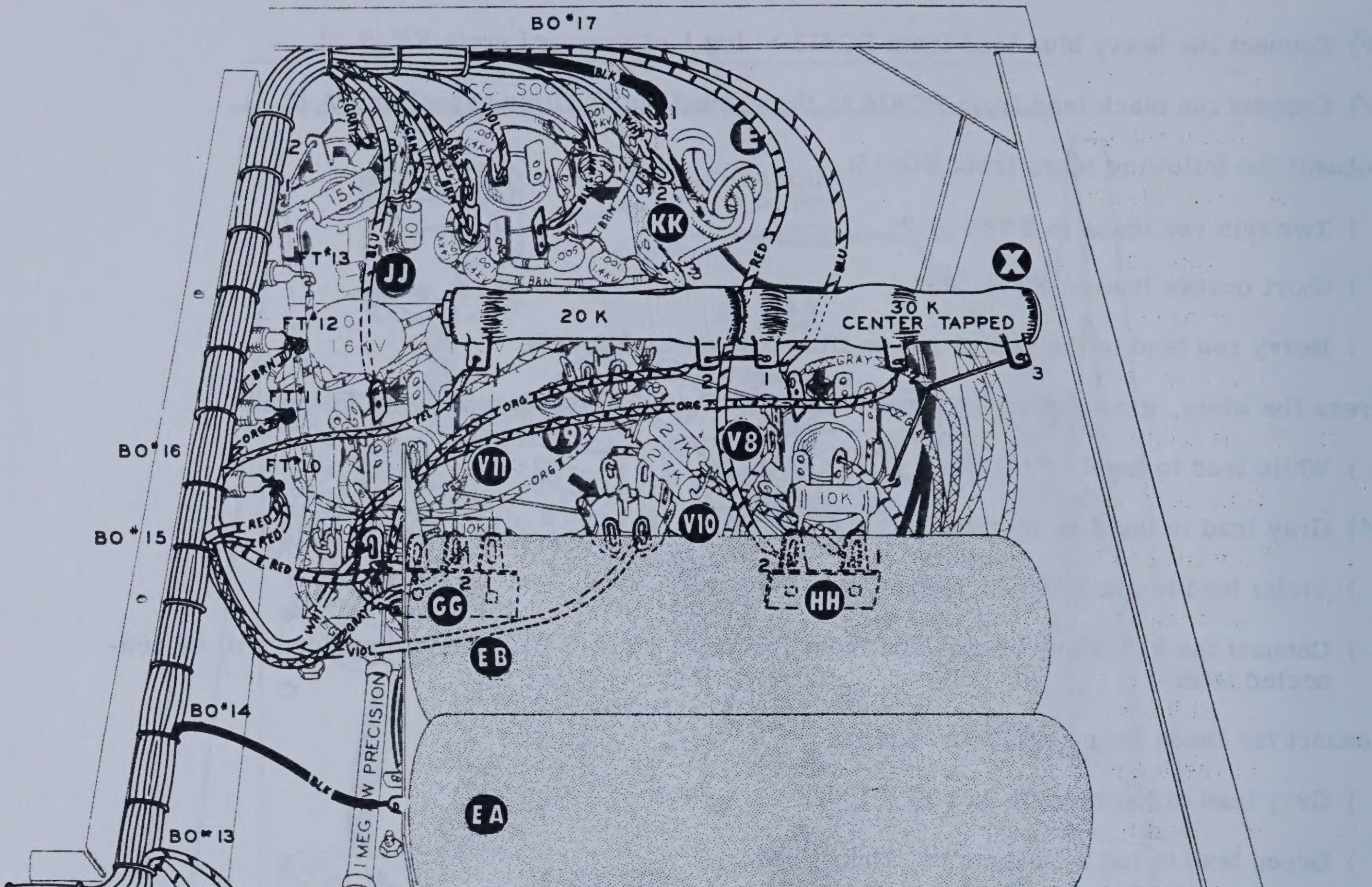
( ) Heavy white lead to lug 2 of terminal strip KK (S-3).

(✓) Heavy blue lead to pin 8 of tube socket V8 (S-2).

+ ( ) Red lead to lug 2 of terminal strip HH (S-3).

(✓) Cut a bare wire to 1 1/2" in length. Connect one end to ground lug 2 of V8 (S-1). The other end will be connected later.

( ) Referring to Pictorial 30, mount the 30 KΩ center-tapped and 20 KΩ 25 watt resistors at location X. Place the long #10-24 bolt through hole X, through a #10 fiber washer, through the 30 KΩ center-tapped resistor, through a second #10 fiber washer, through the 20 KΩ resistor, through a third #10 fiber washer, and secure with a #10-24 nut. Position the resistor lugs to the side facing the filter capacitors, as shown.


BO#17
E
KK
X
JJ
15K
FT#13
FT#12
FT#11
FT#10
BO#16
BO#15
BO#14
BO#13
20 K
30 K
CENTER TAPPED
V8
V9
V10
V11
27K
10K
GG
HH
EB
EA
1 MEG 1% PRECISION
B
FF
C
BLK
RED
BLU
GRAY
ORG
YEL
VIOL
BRN

Pictorial 30

(✓) Connect the other end of the bare wire from ground lug 2 of V8 to lug 3 of the 30 KΩ center-tapped bleeder resistor (S-1).

( ) Cut an orange hookup wire to 7" in length and strip both ends 1/4". Connect one end to lug 2 of the 30 KΩ center-tapped bleeder resistor (S-1), and connect the other end to the top outer lug of filter capacitor EB (S-2).

( ) Cut an orange hookup wire to 4" in length. Strip one end 3/4" and the other end 1/4". Pass the 3/4" stripped end through lug 2 of the 20 KΩ screen dropping resistor and connect to lug 1 of the 30 KΩ center-tapped bleeder resistor. Solder both connections. Connect the other end to the center lug of filter capacitor EB (S-3).

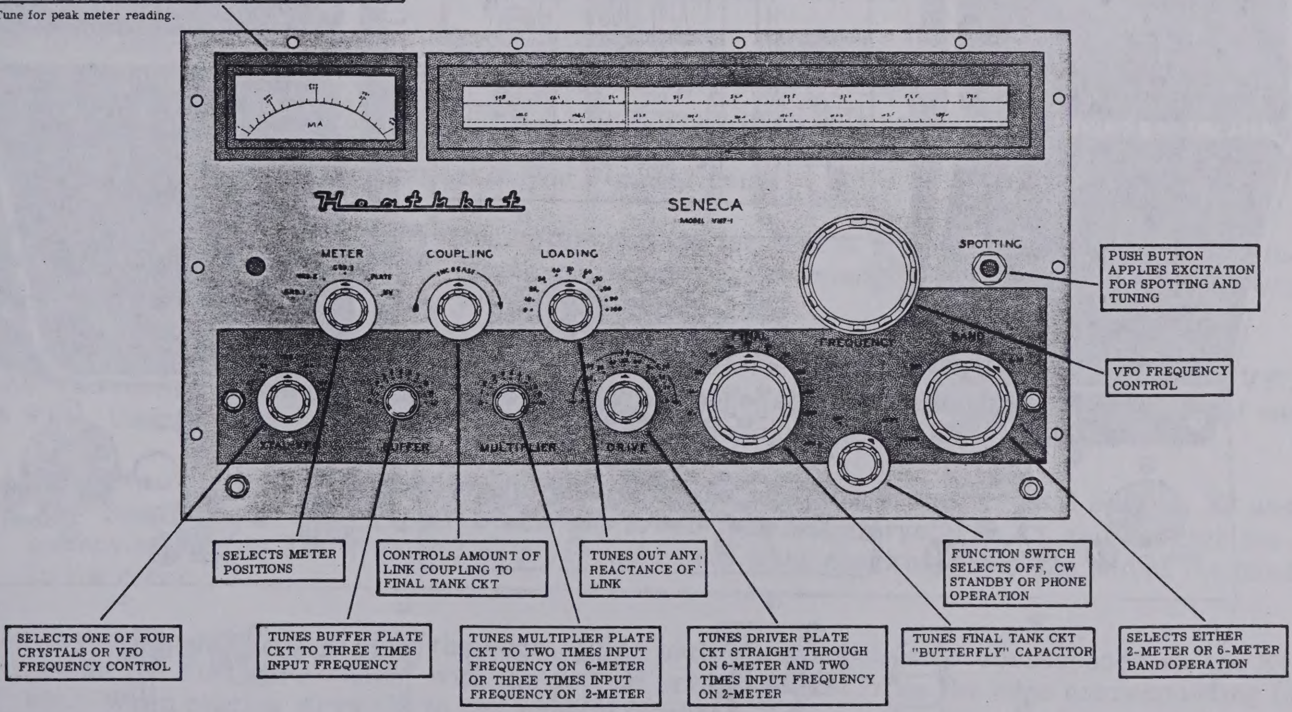
( ) Connect the yellow lead from BO#15 to lug 1 of the 20 KΩ screen dropping resistor (S-1).

( ) Install the fuse plug on the other end of the line cord as follows: Open the plug to expose the screw terminals. Split the line cord approximately 1" back from the end and separate the leads. Strip the end of the leads to 1/2" and tin. Position the cord in the "bell" of the plug, run the leads along the separate channels provided and connect the wires to the screw terminals with a hook in the same direction as the screw rotation. Reassemble the plug and install two type 3AG fuses rated not higher than 8 amperes.

This completes all wiring of the Kit. The two orange leads connected to FT11 on the outside of the driver housing, and the heavy red lead connected to FT15 on the outside of the final amplifier housing, are purposely left unsoldered at this time. Disconnect these leads from the feed-through capacitors and position them so they don't short out to other components. These leads are left disconnected until neutralization of the final amplifiers is accomplished.

METER SW. POS	MEASURES	SCALE
GRD 1	MULTIPLIER GRID CURRENT	0 - 6 MA *
GRD 2	DRIVER GRID CURRENT	0 - 6 MA *
GRD 3	FINAL GRID CURRENT	0 - 6 MA
PLATE	FINAL PLATE CURRENT	0 - 400 MA
HV	FINAL PLATE VOLTAGE	0 - 1000 VOLTS

*Tune for peak meter reading.



PUSH BUTTON APPLIES EXCITATION FOR SPOTTING AND TUNING

VFO FREQUENCY CONTROL

SELECTS METER POSITIONS

CONTROLS AMOUNT OF LINK COUPLING TO FINAL TANK CKT

TUNES OUT ANY REACTANCE OF LINK

FUNCTION SWITCH SELECTS OFF, CW STANDBY OR PHONE OPERATION

SELECTS ONE OF FOUR CRYSTALS OR VFO FREQUENCY CONTROL

TUNES BUFFER PLATE CKT TO THREE TIMES INPUT FREQUENCY

TUNES MULTIPLIER PLATE CKT TO TWO TIMES INPUT FREQUENCY ON 6-METER OR THREE TIMES INPUT FREQUENCY ON 2-METER

TUNES DRIVER PLATE CKT STRAIGHT THROUGH ON 6-METER AND TWO TIMES INPUT FREQUENCY ON 2-METER

TUNES FINAL TANK CKT "BUTTERFLY" CAPACITOR

SELECTS EITHER 2-METER OR 6-METER BAND OPERATION

Pictorial 31

( ) Install the short length of coaxial cable between the multiplier subchassis and the driver housing.

( ) Rotate the shafts of the BUFFER, MULTIPLIER, DRIVE, FINAL and LOADING capacitors for full mesh of the plates. Refer to Pictorial 31 on page 77 for knob placement.

( ) Locate the two split bushings and place over the BUFFER and MULTIPLIER shafts with the split facing toward the bottom edge of the panel. Now install the two small knobs over the split bushings with the pointers on the knobs facing the "0" marking on the panel and secure, using 8-32 x 1/8" Allen setscrews.

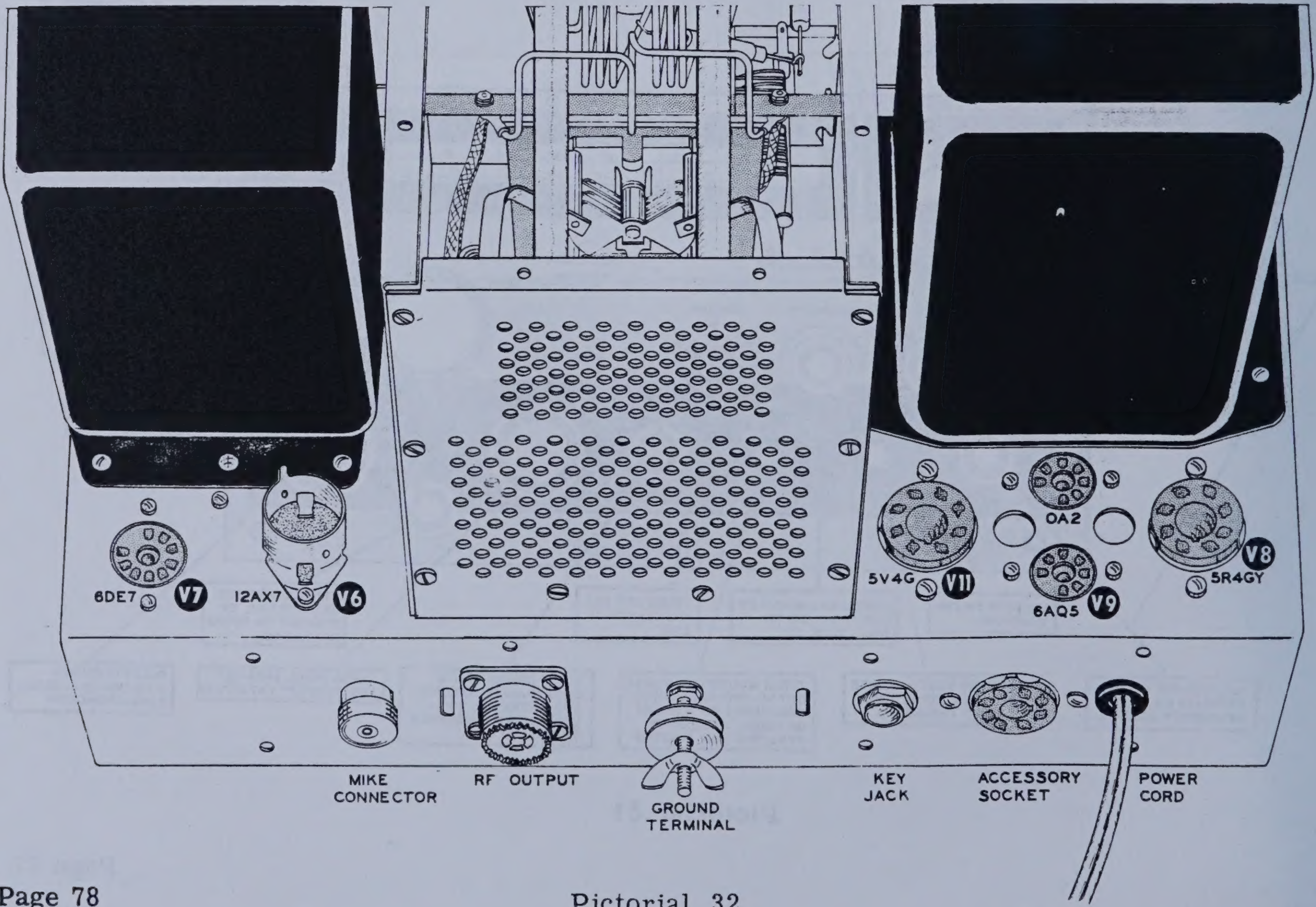
( ) Locate the six 1 1/4" diameter knobs and start 8-32 x 1/4" Allen setscrews in each. Install three of the knobs on the XTAL-VFO, METER and FUNCTION switch shafts, positioning the pointer on the knobs opposite the flats on the shafts. Then tighten the setscrews.

( ) Install the other three 1 1/4" diameter knobs on the COUPLING, LOADING and DRIVE shafts. Position the pointer of the knob at the LOADING location at the "0" marking, and the pointer of the knob at the DRIVE location at the "0" marking on the "6M" side of the scale. The COUPLING knob does not require any special positioning.

( ) Install the large VFO knob at the FREQUENCY location, making sure there is clearance between the knob and the front panel escutcheon.

( ) Install the remaining 1 3/4" diameter knob on the FINAL tuning shaft with the pointer at the "0" marking.

( ) A drop of light machine oil on all shaft bushings will insure smooth and easy operation. CAUTION: Do not get oil on the dial cord grooves of those shafts that are used to drive dial cords, as slippage will result.



Pictorial 32

( ) Reinstall the 6146 tubes in their sockets V4 and V5. Insert 6-32 x 1/4" screws through the slotted holes in the tabs connected to the tuned lines, then through the silver plated strips connected to the "butterfly" capacitor and secure to the plate caps. Make sure the silver plated strips don't come in contact with the tuned lines other than at the plate caps. Also position the tuned lines so that the ends don't come in contact with the plate caps.

( ) Locate the final amplifier back shield. This is the square perforated shield with a 3/8" flange across the top. Mount to the back of the final amplifier housing, using six #6 self-tapping screws and two 6-32 x 1/4" screws.

( ) Insert all remaining tubes in their sockets, except the 5R4GY HV rectifier. See Pictorial 32 for identification of sockets. Also install the remaining tube shield over the 12AX7 tube at V6.

PRELIMINARY OPERATION CHECKS

Before applying power to the Transmitter, examine your wiring very carefully for possible shorts, such as tube pins touching, resistor or capacitor leads contacting the chassis or shield housings, and switch contacts shorting to the switch frame. Also be sure no wire clippings or solder drops are still in the chassis.

If there are any short circuits, serious damage will result to the tubes and components when power is applied. As an additional check, connect an ohmmeter from pins 8 of V8 and V11 to ground, with the power off. It should read approximately 30 KΩ or above in all positions of the function switch. Any abnormal low reading must be completely investigated before applying power.

Again, before applying power, check all solder connections. Make sure none have been missed except for the three connections mentioned previously, and that all are good electrical connections. Check the three coaxial cables for continuity and also for possible "shorts" to the coaxial shield.

TESTING, ADJUSTMENT AND CALIBRATION INSTRUCTIONS

Due to the fact that the "Seneca" Transmitter can be operated by three types of licensed amateurs (General, both bands; Technicians, 6-meter band; Novice, 2-meter band 75 watts maximum input, crystal control only), the following adjustments need only pertain to the band that will be used. For the general licensee who wishes to operate both bands, start the adjustment procedure on the 6-meter band and then repeat on the 2-meter band.

See Pictorial 31 on page 77 for a description and the location of all operational controls on the Transmitter before beginning the tuning procedure. A knowledge of each control function will assist in accomplishing the tuning without difficulty.

If crystals are unavailable or are not going to be used refer to page 83 and proceed with the VFO calibration first. Then come back to this page and proceed with the following steps except use the VFO, tuning it from one end of the band to the other, in place of the crystals.

( ) Select two crystals, preferably near the band edges, and plug in the *crystal sockets X3 and X4. See Table 1 on page 104. Place the lower frequency crystal in X3 and the high frequency crystal in X4. This will help prevent mixup when checking from one end of the band to the other.

*The crystal socket located near the edge of the multiplier subchassis corresponds to the X4 position on the Xtal-VFO switch, with the second crystal socket from the edge corresponding to X3, etc. When placing crystals in the crystal sockets, remove the line cord from the outlet to prevent possible shock hazard.

( ) Before applying power, set the controls and switches as follows:

XTAL-VFO:	X3 (or VFO).
BUFFER:	Pointer at "0" setting.
MULTIPLIER:	Pointer at "0" setting.
DRIVE:	Pointer at "50" setting.
FINAL:	Any setting.
FUNCTION:	STBY position.
BAND:	Set band switch to proper band for crystals being used.
METER:	GRD 1 position.
COUPLING:	Full CCW.
LOADING:	Pointer at "0" setting.
FREQUENCY:	No special setting at this time unless VFO is being used.

( ) At this point, the meter should be studied carefully to determine just how the meter reads for the various positions of the meter switch. First note that the meter has three scales: bottom scale, 0-6 ma; center scale 0-400 ma; top scale 0-1000 volts. The scales should be interpreted as follows:

METER SWITCH POSITION	MEASURES	RANGE OF READING
GRD 1	Multiplier grid current	0-6 ma*
GRD 2	Driver grid current	0-6 ma*
GRD 3	Final grid current	0-6 ma
PLATE	Final plate current	0-400 ma
HV	Final plate voltage	0-1000 volts

* Tune for peak meter reading.

CAUTION: BEFORE APPLYING POWER TO THE TRANSMITTER, IT SHOULD BE NOTED THAT LETHAL VOLTAGES ARE PRESENT BOTH ABOVE AND BELOW THE CHASSIS. CARE SHOULD BE EXERCISED NOT TO TOUCH ANY HIGH VOLTAGE POINTS WITH YOUR HANDS. WELL INSULATED TOOLS SHOULD BE USED FOR ANY ADJUSTMENTS BEHIND THE PANEL.

( ) Place the Transmitter upside down for the following steps.

( ) Plug the Transmitter into a 117 volt AC, 50-60 cycle outlet and check to be sure that all tubes and dial lights light up. Unplug the line cord if any overheating is observed.

( ) If nothing unusual is observed under these conditions after a short time, depress the spotting push button switch and adjust the buffer tuning control for a peak reading on the meter. The average crystal should give a reading to about midscale on the meter.

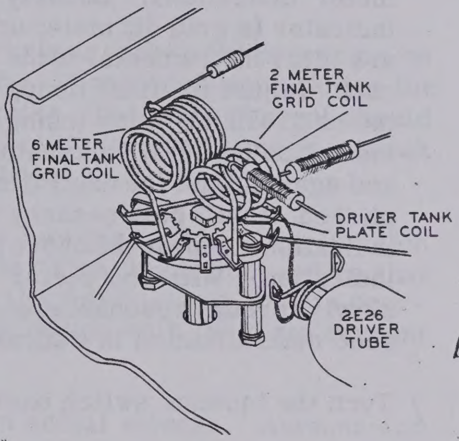
( ) Now move the meter switch to the GRD 2 position. Depress the spotting push button switch again and adjust the multiplier tuning control for a peak reading on the meter. With the band switch in the 6-meter position you should get almost a full scale indication, and in the 2-meter position you should get about a midscale indication. If more than one meter indication occurs, always tune for the largest indication.

( ) At this point, change crystal positions and repeat the two above steps. If the readings obtained on the meter with the meter switch in the GRD 2 position differ, between the two crystals, by a large margin and the meter indication shows about equal indications in the GRD 1 position, check the LC ratio of the multiplier plate tank circuit. If the multiplier tuning capacitor plates are completely meshed for peak meter indication when using the low frequency crystal, compress the turns on the tank coil slightly. (If the band switch is in the 6-meter position this will be the coil with six turns, and with the band switch in the 2-meter position it will be the three turn coil.) If the tuning capacitor plates are completely open for peak meter indication when using the high frequency crystal, spread the turns on the tank coil slightly.

( ) Now move the meter switch to the GRD 3 position. Depress the spotting push button switch and adjust the drive tuning control for peak meter indication but do not exceed 6 ma. Normal final grid current should be about 4.5 ma on both bands. Again, if normal meter indication occurs with one crystal but not with the other, check the LC ratio of the driver tank circuit. NOTE: With the band switch in the 2-meter position and with a crystal operating at the high end of the band, the driver tank capacitor will be almost completely out of mesh; the reverse is true with the band switch in the 6-meter position, using a crystal at the low end of this band.

If the driver tank coil has to be adjusted, the turns will only have to be spread or compressed slightly. If the LC ratio of the driver tank circuit has been corrected or appeared to be correct and still sufficient final grid drive cannot be obtained, it will be necessary to adjust the position of the final grid tank coupling coils. See Detail 23 for identification of the coils. Only a slight adjustment of the coils for coupling is necessary.

CAUTION: Use an insulated tool when making these adjustments. If adjustment of the final grid tank coils was necessary, there will be some interaction to the driver tank coil and its turns may have to be readjusted.



Detail 23

( ) When proper operation of the multiplier and driver circuits is obtained, install the multiplier bottom shield to the multiplier subchassis and secure with six #6 self-tapping screws. Be sure the screw ends do not come in contact with any components in the subchassis.

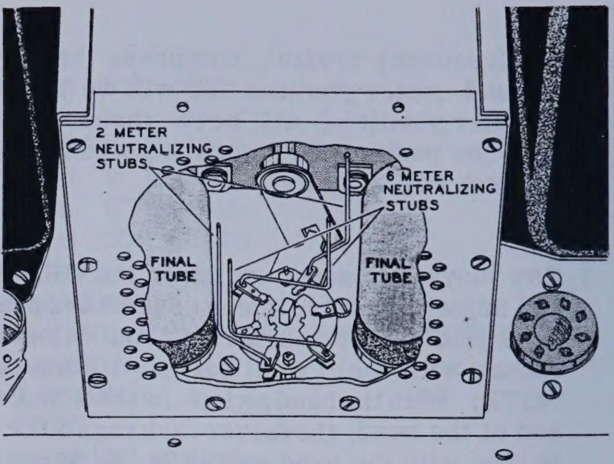
( ) Locate the driver bottom shield. This is the shield with perforations in the center and a 1/4" flange at one end. Butt the flange end against the rear apron of the chassis and secure in place with six #6 self-tapping screws.

( ) Turn the transmitter over in its normal position.

NEUTRALIZATION ADJUSTMENT

The final amplifier tubes are neutralized to reduce to a minimum the RF driver voltage fed from the input of the final amplifier to the output tank circuits through the grid plate capacitance and the inherent inductance of the screen leads within the tubes to prevent self-oscillation or regeneration. This is done by adjusting carefully, bit by bit, the neutralizing stubs in the final amplifier compartment until an RF indicator coupled to the final plate tank circuits reads minimum. Both neutralizing stubs are adjusted simultaneously and to approximately the same physical positions until minimum RF is indicated for resonant settings of both the drive and final tuning capacitors.

( ) Refer to Detail 24 and notice that the two stubs that cross over the top of the switch wafer are the 6-meter neutralizing stubs and the other two are the 2-meter neutralizing stubs.



Detail 24

( ) Select a crystal frequency near the low end of the band being used, or if normal operation is proposed in one section of the band, select a crystal in the middle of that section. Turn the function switch to the CW position. You should hear the relay being energized. Tune the buffer, multiplier, and drive tuning controls as before for peak meter indications. Loosely couple an RF indicator (a grid dip meter or a wave meter are ideal instruments) to the final tank circuit. Adjust the final tuning control for a peak indication on the RF indicator. Now adjust the neutralizing stubs (using an insulated tool such as the nut starter) for a null or minimum indication on the RF indicator. Readjust the final tuning control for peak indication again, and again adjust the neutralizing stubs for minimum indication. As neutralization is accomplished, it will be necessary to couple the RF indicator closer to the tank circuits for ample indication. Repeat the above procedure until further adjustments produce no further minimum indication. With the meter switch in the GRD 3 position, adjust the Final tuning control slowly through resonance and if the meter indication on the front panel remains constant, good neutralization is indicated. A further check of neutralization will be made later.

( ) Turn the function switch back to STBY and unplug the line cord.

( ) Connect the heavy red lead back on FT15 (S-1).

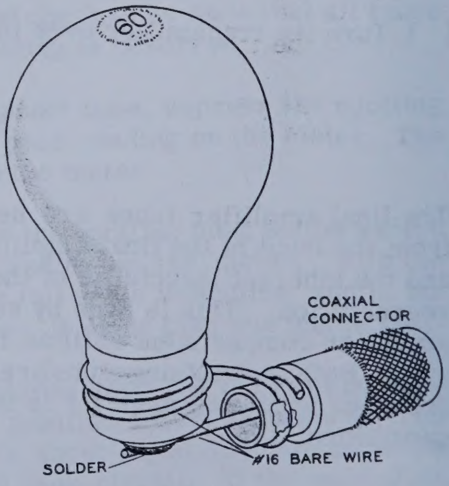
( ) Connect the two orange leads back on FT11 (S-2).

( ) Locate the octal plug and connect a bare wire jumper from pin 3 to pin 4. Solder both connections. Snap the octal plug shield in place. Install the octal plug in the accessory socket.

( ) Install the 5R4GY HV rectifier tube in socket V8. Apply power to the Transmitter with the function switch in STBY position and allow to warm up a few minutes.

( ) If a 50 or 72 Ω pure resistive load is available, connect it to the RF coaxial output connector on the rear apron of the chassis. An alternate load can be made up, using a 60 watt light bulb. Unfortunately, the common light bulb has high inductive reactance at these frequencies, but if the light bulb load is made up as shown in Detail 25, it will suffice for preliminary adjustments of the Transmitter. NOTE: The brilliance of the light bulb is not a true indication of the actual power output capabilities of the Transmitter. If the light bulb load is used, install directly on the coaxial connector at the rear of the chassis.

( ) Rotate the coupling tuning control CW and check to be sure the link coupling does not come in contact with the tuned lines or the 6-meter tank coil during its travel. Return the link coupling coil to its original position.



Detail 25

( ) To test the final amplifier, be sure the preceding stages are all tuned for peak meter indication (GRD 3 maximum of 6 ma). Move the meter switch to the "Plate" position and turn the function switch to the CW position. Return the switch to STBY immediately in case of an arc, apparent overload, or an excessive meter reading (over 350 ma). Adjust the final tuning control quickly for a minimum meter indication. Now slowly adjust the coupling control CW while maintaining a minimum meter indication with the final tuning control. As the coupling is increased, the minimum meter indication should increase, as should the light bulb's brilliance. At the same time, adjust the loading control for maximum meter indication. Repeat this procedure, adjusting the three individual controls until a normal operating load of 230 ma of plate current indication is reached. Recheck the amount of grid drive. If the reading has dropped, readjust the drive control for maximum grid indication (not over 6 ma), then recheck the final plate current. Depending upon the type of light bulb being used for a dummy load, you may find it difficult to load the final amplifier to the normal load of 230 ma. In this case, adjust for maximum bulb brilliance at minimum plate current indication. Return the function switch back to STBY position.

( ) Connect a crystal, ceramic, or high impedance dynamic microphone to the mike connector on the rear apron of the chassis. Move the function switch to the "Phone" position. Notice the plate current indication is about 50 ma. Now speak into the mike. The plate current should swing upscale to about 200 ma with the light bulb varying in brilliance each time you speak into the mike. Return the function switch back to STBY position.

( ) To check CW operation, insert the plug from a key into the key jack. Move the function switch back to the CW position. With the meter switch still in "Final" position, notice that the resting plate current is about 50 ma. This indicates that the 6AQ5 clamp tube is operating properly. Now depress the key and the light bulb should light with the plate current rising to the normal operating load of 230 ma.

The tuning procedure just outlined will also apply when loading an actual antenna. Antenna and grounding considerations will be covered later.

VFO CALIBRATION

An electronic counter of good quality, a frequency standard such as the surplus LM or BC series, or a 100 KC crystal calibrator are all excellent pieces of equipment for calibration, if properly used and checked against WWV. For those kit builders that do not have access to the type of equipment just mentioned, a selection of crystals, preferably near the band edges, should be accumulated.

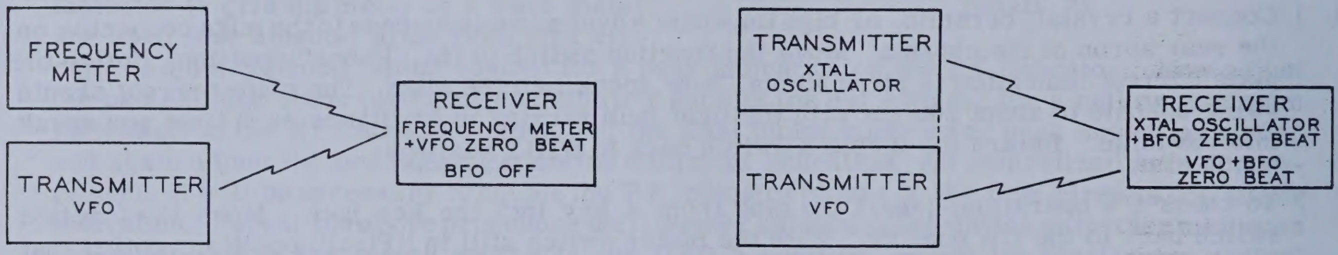
NOTE: Not all crystals are exactly on frequency as marked on the crystal holder due to aging, poor original calibration or oscillator circuit variations. This is particularly true of the surplus type of crystals.

The crystals may be installed in the *crystal sockets of the Transmitter and compared to the VFO frequency by means of a nearby receiver having a BFO. If a frequency meter or a crystal calibrator is used, it can beat against the VFO frequency in the receiver. A frequency counter, of course, can count and display the VFO frequency directly. (Do not use ordinary radio service generators.) The receiver must be capable of tuning between 8000 KC and 9000 KC, or the harmonics of these frequencies such as 16, 24, 32, ..., 50 or 144 MC.

*The crystal socket located near the edge of the multiplier subchassis corresponds to the X4 position on the Xtal-VFO switch, with the second crystal socket from the edge corresponding to X3, etc. When placing crystals in the crystal sockets, remove the line cord from the outlet to prevent possible shock hazard.

Before beginning calibration, remove the 5R4GY high voltage rectifier tube and insert the plug from a key in the key jack. Leave the key open during the calibration procedure. With the function switch in STBY position, allow the Transmitter, frequency meter or crystal calibrator, if used, and receiver to warm up for at least one half hour or more.

During the calibration procedure, the function switch should be on the CW position and the meter switch in the GRD 1 position. If a frequency meter is used for calibration, the frequency meter signal and the VFO signal should be zero beat against each other in a receiver with the BFO off. Be sure to avoid setting the receiver on image frequencies. Under these conditions the VFO frequency is the same as the frequency meter. See Figure 10A. If crystals are being used for calibration, set the receiver to the crystal frequency with the BFO on and zero beat the BFO in the receiver against the crystal oscillator signal from the Transmitter. Then set the VFO to zero beat against the receiver, which is still tuned to the crystal frequency. Under these conditons, the VFO frequency is the same as the crystal frequency. See Figure 10B.


FREQUENCY METER
TRANSMITTER VFO
RECEIVER
FREQUENCY METER +VFO ZERO BEAT
BFO OFF
TRANSMITTER XTAL OSCILLATOR
TRANSMITTER VFO
RECEIVER
XTAL OSCILLATOR +BFO ZERO BEAT
VFO +BFO ZERO BEAT

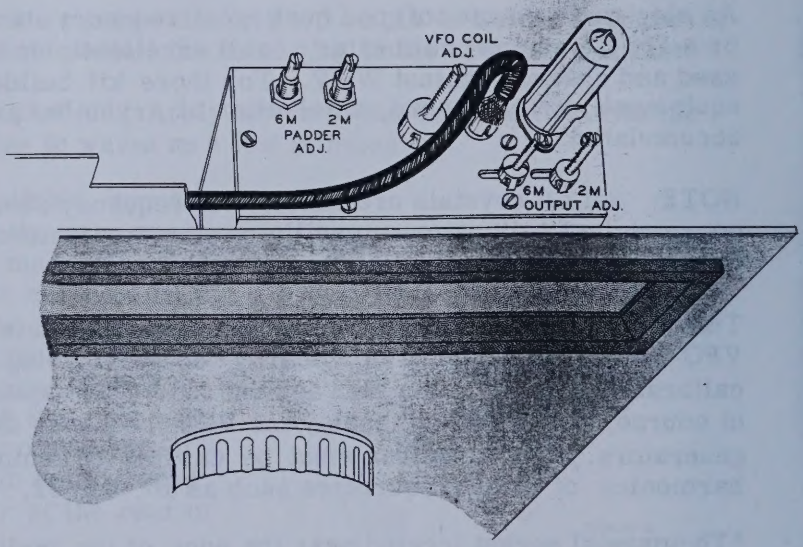
10A

10 B

Figure 10A & 10B

If a crystal calibrator is used for calibration, be sure you know which marker is the proper frequency. Aside from these slight differences in measurement technique, the following procedure may be used for either method of calibration. Refer to Pictorial 33 for location and identification of the various calibrating adjustments.

NOTE: It should be noted that the trimmer capacitors (6M and 2M in Pictorial 33) are used to set the bandspread covered on the dial while the VFO coil slug is used to set a definite frequency point on the dial. The slug is set to the calibration frequency near the low end of the dial and the trimmers are adjusted so that the calibration frequency at the high end of the band coincides with the dial reading. These two adjustments interact with each other and, therefore, will have to be adjusted alternately until optimum overall calibration is obtained. Both trimmer capacitors should be set to full



Pictorial 33

open (both plates completely unmeshed) before starting calibration, as indicated by the marks placed on the shafts and chassis when the VFO subchassis was mounted. Make sure the steps regarding the setting of the VFO tuning capacitor in relation to the dial mechanism were not overlooked or done improperly.

CALIBRATION WITH FREQUENCY METER

For 6-meter calibration, adjust the VFO tuning so that the dial pointer sets over the 50.0 marking. Set both the frequency meter and the receiver to 8334 KC with the receiver BFO off. Adjust the VFO coil slug for zero beat against the frequency meter signal in the receiver. Now set the dial pointer over the 54.0 marking and set the frequency meter to 9000 KC. Tune the receiver toward 9000 KC with the BFO on and note the dial reading where the VFO zero beats with the receiver. Then set the receiver to 9000 KC with the BFO off and adjust padder 6M for zero beat in the receiver. Return the dial pointer to the 50.0 mark and reset the frequency meter and receiver to 8334 KC. Readjust the VFO coil slug for zero beat once again. Move the dial pointer back to the 54.0 calibration mark and when tuning the receiver back to 9000 KC with the BFO on again, it should be found that the dial reading for zero beat is closer to the actual frequency than before. Adjust padder 6M again for zero beat with the frequency meter and receiver reset to 9000 KC and repeat this process until calibration is achieved at both ends of the band.

For 2-meter calibration, move the band switch to the 2M position. Adjust the VFO tuning so that the dial pointer sets over the 144.0 marking. Set both the frequency meter and receiver to 8000 KC and adjust padder 2M only for zero beat. This is the only adjustment necessary if the 6-meter calibration has been done properly, since the VFO coil is common to both bands.

CALIBRATION WITH CRYSTALS

The calibration procedure outlined above using a frequency meter can be repeated using crystals, except the receiver will be set to zero beat, with the BFO on constantly, against the Transmitter crystal oscillator frequency. Move the Xtal-VFO switch to the low frequency crystal position and zero beat the receiver. Now move the Xtal-VFO switch to the VFO position and tune the VFO so that the dial pointer sets over the dial marking which corresponds to the crystal frequency. (Refer to Page 104 at the back of the manual for interpolation of the dial readings against the fundamental frequency of the VFO.) Adjust the VFO coil slug for zero beat in the receiver, with the receiver still tuned to the crystal frequency. Now move the Xtal-VFO switch to the high frequency crystal and tune the receiver to zero beat against this crystal frequency. Return the Xtal-VFO switch back to VFO position and set the VFO dial pointer over the dial mark corresponding to the high frequency crystal. Adjust padder 6M for zero beat in the receiver with the receiver still tuned to the high frequency crystal. As mentioned before, repeat this process until calibration is achieved. For 2-meter calibration, use the proper crystal frequency for that band.

( ) After VFO calibration is complete, adjustment of the output coils may be accomplished. Move the band switch to the 6M position and set the VFO dial pointer to the middle of the band (52 mc). Tune the buffer control for maximum meter indication (meter switch in GRD 1 position). Now adjust output coil slug 6M for maximum meter indication.

( ) Move the band switch to the 2M position and repeat the above step except adjust output coil slug 2M. Meter indication on both bands should read about half scale.

NOTE: Peaking the output coils may affect VFO calibration, therefore it may be necessary to touch up VFO calibration.

( ) If the TESTING and ADJUSTMENT INSTRUCTIONS have not been followed, refer back to Page 79. Otherwise this completes testing, adjustment and calibration of your VHF-1 Transmitter.

INSTALLATION OF TRANSMITTER IN CABINET

( ) Mount the final amplifier top shield, with the larger perforation area towards the back of the housing, using eight #6 self-tapping screws.

( ) Install the four large rubber feet on the cabinet. Use 8-32 x 3/8" screws, inserting the screws through the rubber feet and then through the cabinet bottom. Use #8 lockwashers under the nuts and tighten securely.

( ) Place the Transmitter in front of the cabinet and pass the line cord through the opening in the back of the cabinet. Now slide the Transmitter onto the rails and into the cabinet while guiding the line cord through the opening in the back. Use ten #10-32 Phillips head screws to fasten the front panel to the cabinet, and eight #6 sheet metal screws through the back of the cabinet into the rear chassis apron.

( ) Place the rear apron diagram adhesive label on the back of the cabinet, just above the opening on the solid metal between the two center sheet metal screws.

Your Heathkit VHF-1 Transmitter is now ready for installation and operation.

OPERATION

The tuning procedure outlined previously will also apply when loading an actual antenna. A point not covered under the tuning procedure is the method by which the VFO may beat against an incoming signal without placing the Transmitter on the air. When operating either PHONE or CW, depressing the spotting push button on the front panel will provide a signal from the exciter stages of the Transmitter that can be picked up on the receiver. Then the VFO can be tuned for zero beat against the incoming signal. If the frequency excursion is more than 200 kc, it may be necessary to retune the buffer, multiplier, and driver stages. When the Transmitter is again placed on the air, the final amplifier may require touching up to compensate for the frequency change.

For operation on 2-meters, reduce the loading to 185 ma of final plate current in order to prolong longer final amplifier tube life.

Novice Operation: At the press time of this manual the maximum power input for novice operation is 75 watts crystal control only between the frequency ranges of 145 to 147 megacycles. Either PHONE or CW operation is permissable within this frequency range. Maximum loading point for 75 watts input is 125 ma of final plate current.

A further check on the neutralization can be made by noting whether maximum grid current indication occurs at the same point of tuning on the final tuning capacitor as minimum plate current indication. As the final tuning capacitor is detuned slightly from resonance on either side, the grid current of the final stage should decrease the same amount and without any sudden jumps on either side of resonance. This indicates accurate neutralization provided the load is non-reactive at the operating frequency.

Be sure and check the neutralization each time a final amplifier tube is replaced.

Accessory Socket

See Figure 11 for a diagram of the accessory socket. This is the octal socket located on the rear apron of the chassis. It provides connections for external duplication of the function switch and provides 117 volts AC for antenna or receiver muting relay. It also has a connection for receiver muting which is wired "normally closed".

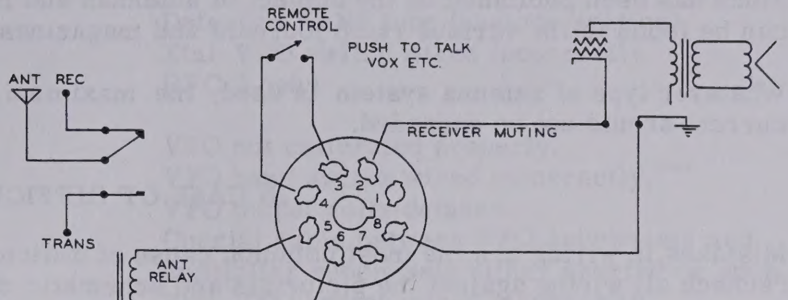


Figure 11

Antennas and Grounding

The link coupling network output circuit of the VHF-1 Transmitter will match pure resistive loads from approximately 50 to 72 Ω. Therefore, the Transmitter will match antennas and unbalanced transmission lines within these limits, provided such antennas or transmission lines are non-reactive. Most commercial or "home-brewed" antennas, including beams, and verticals in use today are designed to be fed with 50 or 72 Ω coaxial cable. If an antenna with a balanced transmission line is desired, it is recommended that an antenna coupler be obtained or a balun be made up. Such units are available commercially or can be built from published literature at a reasonable cost. An antenna coupler is almost a necessity to properly match transmission lines of high impedance used to feed antennas such as the "V" or rhombics, but a simple balun can be made of coaxial cable to match the Transmitter output to a balanced feed line. Such a system is shown in Figure 12. NOTE: Baluns of this type offer only a 4:1 impedance match. Thus, an antenna which is matched to a 300 Ω balanced transmission line, should have a balun made of 72 Ω coax, with the unbalanced line connected to the Transmitter being of 72 Ω coax also. Either transmission line may be of any length.

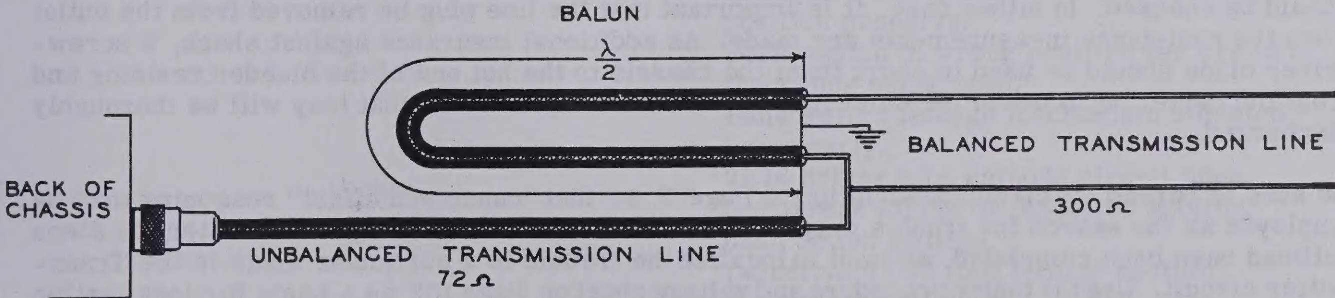


Figure 12

Low Pass Filters

The harmonic rejection of the link coupling output circuit of the VHF-1 is good and will attenuate harmonics considerably when the Transmitter is properly grounded and carefully tuned. However, additional harmonic attenuation may be had with the use of a low pass filter connected between the output of the Transmitter and the feed line to the antenna. Such a filter should be designed to handle the maximum power output of the Transmitter and must be operated into its nominal impedance.

Grounding

Proper grounding techniques are very important at these frequencies. A flexible braid or copper strap at least 1/2" wide should be connected to the ground lug of the Transmitter located on the rear apron of the chassis and connected to a ground rod which extends into the earth at least 6 feet. Make the run as short and direct as possible. If the Transmitter location and ground rod are over a half wave length away from each other at the operating frequency, a system of three or more grounding straps, each one a different length, should be connected to the ground rod. Do not use gas pipes, electrical conduit or water pipes that are a part of the structure of a dwelling. Water pipes are not good grounds, because of the pipe compound used on pipe joints and the corrosion that develops between the joints.

Much has been published on the subject of antennas and matching devices and excellent articles can be found in the various radio journals and magazines.

Whatever type of antenna system is used, the maximum loading point of 230 ma of final plate current should not be exceeded.

IN CASE OF DIFFICULTY

Mistakes in wiring are the most common cause of difficulty. Consequently, the first step is to recheck all wiring against the pictorials and schematic diagrams. Often having a friend check the wiring will locate an error consistently overlooked.

With miniature sockets, there is a possibility of shorts between adjacent socket terminals due to the close spacing. This should be checked and if any doubt exists, the terminals should be pried apart until obvious spacing can be seen between them.

Sometimes apparently good solder connections will have an insulating coating of rosin between the wire, the terminal and the solder. This is often the case when insufficient heat was applied in soldering. An ohmmeter check of any questionable connections will test for this condition. Naturally, all voltages should be "off" for such tests.

The Transmitter is fused at the line cord plug. A type 3AG fuse is required on each side of the line plug with a rating not in excess of 8 amperes. Should it be found that fuses consistently blow whenever the equipment is plugged in and the function switch is in STBY, resistance tests of both power supplies should be made. Check the primary circuits, filament circuits, and the relay circuits for possible shorts. If a fuse blows whenever the function switch is in either PHONE or CW position, the resistance tests of both B+ circuits should be made and both rectifier tubes should be checked. In either case, it is important that the line plug be removed from the outlet when the resistance measurements are made. As additional insurance against shock, a screwdriver blade should be used to short from the chassis to the hot end of the bleeder resistor and from the center lug to one of the outer lugs of each filter capacitor so that they will be thoroughly discharged.

Be sure to reread the circuit description on Page 3 so that "cause and effect" reasoning may be employed as the search for trouble progresses. If some difficulty still persists after the steps outlined have been completed, attempt to localize the trouble to a particular stage in the Transmitter circuit. Use the tuning procedure and voltage chart on Page 102 as a basis for localization and refer to the block diagram and schematic to visualize circuit relationships. The panel meter and station receiver are extremely valuable tools to use in locating trouble.

The receiver and/or appropriate converters may be used to check each RF section of the Transmitter by connecting a short length of insulated wire to the receiver and/or converter antenna terminal and bringing the wire near the RF section. Tune the receiver with the BFO on, to determine if a signal is being generated by the respective section. A grid dip meter and wave meter are ideal instruments for checking the RF circuits. Coupling either instrument to the RF section in question will determine if the proper signal is being generated. Last, but not least, a Volt-ohm-milliampere meter (preferably 20,000 ohm/volt) should be available for measuring voltage, resistance, and current.

Due to the complexity of the VHF-1 Transmitter, certain difficulties could arise. Outlined below are some of the possible indications of improper operation and their causes.

TROUBLE	POSSIBLE CAUSES
No meter indication in GRD1 position with Xtal-VFO switch in proper crystal position.	Bad crystal - try different crystal. Xtal-VFO switch in unused crystal socket position.

TROUBLE	POSSIBLE CAUSES
	Defective 6AN8 tube (pentode section). Xtal-VFO switch wired incorrectly. RFC 2 open.
No meter indication in GRD 1 position, with Xtal-VFO switch in VFO position, but have proper meter indication when using crystals.	VFO not calibrated properly. VFO band switch wired incorrectly. VFO output coils detuned. Coaxial cable between VFO subchassis and multiplier subchassis either shorted or open. Xtal-VFO switch wired incorrectly. RFC 1 open. * Defective 6AU6 tube. Defective OA2 regulator tube. *RFC 1 can be checked for continuity by removing the 6AU6 VFO tube from its socket and inserting the ohmmeter probe into pin 7. Connect the other ohmmeter probe to the VFO subchassis. You should have a reading of about 20 Ω.
No meter indication in GRD 2 position.	Coaxial cable between multiplier subchassis and driver housing either shorted or open. Defective or improper bypass capacitor C18. Multiplier tank coils L5-L6 not adjusted properly. Multiplier band switch not moving into position properly. Band switch in wrong position for crystal frequency being used. Band switch linkage mechanism adjusted improperly. 2E26 driver tube cathode circuit open (incorrect wiring or defective spotting push button switch). Defective 6AN8 tube (triode section). Defective 2E26 tube.
No meter indication in GRD 3 position.	Driver band switch in wrong position for crystal frequency being used. Band switch linkage mechanism improperly adjusted. Driver tank coil L7 not adjusted properly. Incorrect wiring to driver band switch. Coils improperly wired to driver band switch. The #16 bare wire leads going through the 5/16" holes in the main chassis shorting to the chassis. Lug 3 or 9 on the neutralization band switch shorting to the base sleeves of the final amplifier tubes. Neutralization stubs shorting to the band switch mounting screws, base sleeve of the final amplifier tubes, or to the amplifier back shield. Defective 2E26 driver tube. Defective 6146 final amplifier tube.

TROUBLE	POSSIBLE CAUSES
Insufficient grid drive (low meter indication in GRD 3 position).	Check all possible causes mentioned above. Improper coupling (positioning) of grid tank coils L8-L9. Improper or defective bypass capacitors C25-C26 from the screen circuits of the final amplifier tubes to ground. Improper lead dress of leads connected from screens of final amplifier tubes (pins 3 of V4 and V5) to FT11. (Dress these leads close to the chassis and away from RF circuitry as much as possible.)
Unable to dip final amplifier (meter switch in PLATE position).	Final tank band switch (rotor) in wrong position for band being used. With band switch in 6M position, LC ratio of final 6-meter tank coil L10 incorrect. (Using a grid dip meter or a wave meter, check resonant frequency range of final tank circuit.) Defective 6146 tube.
Excessive plate current.	Final tank circuit not tuned to resonance. Link coupling coil shorting to tuned lines or 6-meter tank coil. Shorted feed-through capacitor FT15. Loading increased too much. Incorrect neutralization. Defective RF choke RFC 8. Final tank band switch in wrong position for crystal frequency being used. * Defective 6146 tube. * *These two possible causes also indicate trouble in the 6AQ5 clamp circuit which could be due to a defective 6AQ5 tube or incorrect wiring in the clamp circuit.
Unable to load Transmitter properly.	Coaxial cable from final amplifier housing to output connector either open or shorted. Impedance of transmission line incorrect, (must be 50 to 72 Ω from Transmitter). Impedance match of antenna or dummy load to transmission line incorrect. Open or shorted transmission line. (See discussion of Antennas on Page 87.) Final amplifiers not neutralized. Defective 6146 tube.

Insufficient plate current would indicate low plate voltage and this can easily be checked with the panel meter in the HV position. You should have a meter indication of approximately 600 volts. If not, possible causes could be: incorrect wiring of high voltage circuit; defective 5R4GY tube: open HV filter choke; filter capacitors EA and EB wired incorrectly or are leaky; defective meter multiplier resistor R20.

Other possible causes for the above outlined troubles could be defective meter shunts or meter.

If resistance checks of the shunts are made, make sure the meter is disconnected from the circuit. This can be done by moving the meter switch off of the meter shunt circuit being checked.

Inability to obtain modulation could be indicative of trouble in the speech amplifier or modulator circuits, or may simply show a defect in the microphone or cable. Isolate the trouble by disconnecting the microphone connector from the mike input and touch the center portion of the mike input with your finger. The meter will move upscale if the speech amplifier and modulator circuits are all right, pointing to trouble in the microphone or cable. If the meter does not move upscale, this could indicate incorrect wiring of the modulator circuits, or of the function switch. Refer to the voltage chart for checking the modulator circuit.

To aid in trouble shooting, the cable harness leads are marked as to color on the schematic.

SERVICE

If, after applying the information contained in this manual and your best efforts on the unit, you are still unable to obtain proper performance from the Transmitter, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for the purpose of providing Heath customers with a personalized technical consultation service; this service is available to you without charge. The technical consultants are thoroughly familiar with all details of the Transmitter and can usually localize the trouble from a suitable description of the difficulty encountered. It is, of course, necessary that you provide full and complete information concerning your problem when writing to the Technical Consultation Department for assistance. For instance, clearly identify the kit involved, giving the purchase date and, if possible, the invoice number; describe in detail the difficulty that you have encountered; state what you have attempted to do to rectify the trouble, what results have been achieved, and include any information or clues that you feel could possibly be of value to the consultant who handles your problem. Failure to provide complete descriptive details may lead to incorrect assumptions on the part of the consultant and needless delay in the solution to your problem. Quite frequently, when the information given the consultant is complete, concise and reliable, a diagnosis of the difficulty can be made with confidence and specific instructions given for its correction. If replacement of a component is involved in the correction, the component will be shipped to you, subject to the terms and conditions of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed Transmitter to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a fixed fee of $20.00, plus the price of any additional parts or material required. However, if the Transmitter is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase and give invoice number, if possible.

Local Service by Authorized Heathkit Dealers is available and often will be your fastest, most efficient method of obtaining service for your Heathkits. Although you may find charges for local service somewhat higher than those listed in Heathkit manuals (for factory service), the amount of increase is usually offset by the transportation charges you would pay if you elected to return your kit to the Heath Company.

Heathkit dealers will honor the regular 90 day Heathkit Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company. It will be necessary that you verify the purchase date of your kit by presenting your copy of the Heath Company invoice to the authorized dealer involved.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if your local dealer assists you in locating a defective part (or parts) in your Heathkit, or installs a replacement part for you, he may charge you for this service.

Heathkits purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized Heathkit dealer in order to be eligible for parts replacement under the terms of the Warranty.

THESE SERVICE POLICIES APPLY ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned NOT repaired.

For information regarding modification of Heathkits for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic outlet stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for specific purposes. Therefore, such modifications must be made at the discretion of the kit builder according to information which will be much more readily available from some local source.

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper Transmitter operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.

B. Identify the type and model number of kit in which it is used.

C. Mention the order number and date of purchase.

D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

In the event that your Transmitter must be returned for service, these instructions should be carefully followed.

ATTACH A TAG TO THE TRANSMITTER BEARING YOUR NAME, COMPLETE ADDRESS, INVOICE NUMBER ON WHICH THE TRANSMITTER WAS PURCHASED, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Wrap the Transmitter in heavy paper, exercising care to prevent damage. Place the wrapped Transmitter in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the Transmitter and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY

Benton Harbor, Michigan

Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit, if in HIS OPINION, the article is inadequately packed for shipment. Your Transmitter will be returned by express collect.

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

HEATH COMPANY

PARTS LIST

Refer to Pages 97, 98, 99, 100 and 101 for identification of parts.

PART No.	PARTS Per Kit	DESCRIPTION
Resistors		
1-1	1	47 Ω 1/2 watt
1-6	1	470 Ω 1/2 watt
1-9	1	1000 Ω 1/2 watt
1-13	1	2.7 KΩ 1/2 watt
1-25	3	47 KΩ 1/2 watt
1-26	3	100 KΩ 1/2 watt
1-33	3	470 KΩ 1/2 watt
1-35	3	1 megohm 1/2 watt
1-37	1	2.2 megohm 1/2 watt
1-40	1	10 megohm 1/2 watt
1A-18	1	150 Ω 1 watt
1A-9	3	10 KΩ 1 watt
1A-26	1	15 KΩ 1 watt
1A-5	1	22 KΩ 1 watt
1B-17	1	6.8 KΩ 2 watt
1B-6	2	27 KΩ 2 watt
1B-10	2	47 KΩ 2 watt
2-137	1	.125 Ω precision 1/2 watt 1%
2-131	1	10 Ω precision 1/2 watt 1%
2-139	2	25 Ω precision 1/2 watt 1%
2B-10	1	1 megohm precision 2 watt 1%
3E-2	1	10 KΩ 5 watt
3Y-1	1	20 KΩ 25 watt
3Y-3	1	30 KΩ 25 watt center-tapped
Capacitors		
20-48	1	.001 mfd 2000 V mica
20-30	1	22 mmf 1000 V silvered mica
20-38	2	100 mmf 500 V silvered mica
20-52	1	7.5 mmf 500 V silvered mica 5%
20-90	2	439 mmf 500 V silvered mica 1%
20-96	1	36 mmf 500 V silvered mica 5%
20-97	1	50 mmf 500 V silvered mica 5%
21-9	6	100 mmf 500 V disc ceramic
21-13	1	500 mmf 500 V disc ceramic
21-43	16	.001 mfd 1 KV disc ceramic
21-71	6	.001 mfd 1400 V disc ceramic
21-27	4	.005 mfd 500 V disc ceramic
21-42	2	.01 mfd 1.6 KV disc ceramic
21-31	2	.02 mfd 500 V disc ceramic
21-29	1	4.7 mmf 500 V tubular N750
21-53	14	.001 mfd 600 V feed-through
21-59	1	.001 mfd 1000 V feed-through
23-58	1	.2 mfd 200 V paper
25-36	1	40 mfd 450 V electrolytic
25-34	2	125 mfd 450 V electrolytic
26-43	1	7 and 14 mmf variable
26-23	1	9 mmf variable
26-48	1	10.5 mmf variable "butterfly"
26-24	3	20 mmf variable
26-49	1	51 mmf variable
26-22	1	75 mmf variable

PART No.	PARTS Per Kit	DESCRIPTION
Coils-Chokes-Transformers		
40-116	1	VFO slug tuned ceramic form coil
40-135	2	VFO output slug tuned coil
40-136	1	Xtal oscillator air wound coil
40-137	1	Multiplier plate coil (6 and 2 meter)
40-139	1	Final plate coil (6 meter)
40-140	1	Link coupling coil
40-141	1	Right hand tuned line coil (2 meter)
40-142	1	Left hand tuned line coil (2 meter)
45-4	2	1.1 mh RF choke
45-36	3	7µh RF choke (6-meter)
46-21	1	HV filter choke, 5-10 h 250 ma DC
46-22	1	LV filter choke, 6 h min. 125 ma DC
54-73	1	Power transformer
Switches-Relay		
63-172	1	Function switch, rotary 4 position
63-173	1	VFO band switch, rotary 2 position
63-175	1	Crystal-VFO selector switch, rotary 5 position
63-176	1	Meter switch, rotary 5 position
63-177	1	Multiplier band switch, rotary 2 position
64-6	1	Push button switch, DPDT (red button)
69-5	1	Relay, 110 V AC DPDT
100-M158	1	Final tank band switch (rotor blades)
163-1	1	Driver band switch assembly with coils mounted
205-118	2	Final tank band switch (fixed plates)
Meters-Tubes		
407-55	1	Meter, 1 ma F.S. 50 Ω
411-11	1	6AU6 tube
411-26	1	12AX7 tube
411-35	1	5V4G tube
411-59	1	OA2 tube
411-60	1	6AQ5 tube
411-68	1	6AN8 tube
411-75	2	6146 tube
411-76	1	5R4GY tube
411-109	1	6DE7 tube
411-119	1	2E26 tube
Terminal Strips-Socket-Wafers-Knobs		
431-2	1	2-lug terminal strip
431-14	1	2-lug terminal strip
431-16	2	2-lug terminal strip
431-27	1	3-lug terminal strip
431-12	1	4-lug terminal strip
431-11	5	5-lug terminal strip
434-34	2	7-pin miniature socket
434-35	1	7-pin miniature ceramic socket

Terminal Strips-Socket-Wafers-Knobs (Cont'd.)

PART No.	PARTS Per Kit	DESCRIPTION
434-38	4	Crystal socket
434-39	3	Octal mica saddle socket
434-42	4	Phono connector socket
434-43	1	9-pin miniature socket with shield base
434-53	3	Octal ceramic saddle socket
434-56	1	9-pin miniature socket
434-75	1	9-pin miniature ceramic socket
434-83	4	Pilot lamp miniature socket
462-58	1	Aluminum knob, 2 1/4" diameter
462-59	2	Aluminum knob, 1 3/4" diameter
462-60	6	Aluminum knob, 1 1/4" diameter
462-61	2	Aluminum knob, 11/32" diameter
481-1	1	Metal capacitor mounting wafer
481-3	1	Insulated capacitor mounting wafer

Gears-Shafts-Bushings-Couplings

PART No.	PARTS Per Kit	DESCRIPTION
100-211	1	Pinion gear assembly
451-16	1	Antibacklash gear
452-3	1	Roll pin, 1/16" dia. x 7/16" long
452-4	1	Roll pin, 1/16" dia. x 3/4" long
453-56	1	Dial drive cord shaft, 1 3/8" long
453-57	1	Band switch shaft, 3 3/8" long
453-58	1	Neutralization switch extension shaft, 5" long
453-60	1	Final tuning extension phenolic shaft, 3 3/4" long
453-61	1	Driver capacitor extension shaft, 4 1/4" long
453-62	1	Antenna coupling dial cord drive shaft, 3 1/8" long
453-63	1	Antenna coupling phenolic shaft, 6" long
453-64	1	Final tank band switch phenolic shaft, 1 7/8" long
453-65	1	Antenna tuning capacitor extension shaft, 3 1/8" long
455-6	4	Shaft bushing, 1/4" long round flange
455-10	2	Shaft bushing, 3/8" long hex flange
455-11	2	Split bushing, 1/4" x 5/16" long
455-13	5	Shaft bushing, 1/4" long hex flange
455-15	1	Retainer bushing
455-17	4	Shaft bushing, 9/16" long hex flange
455-26	1	Shaft bushing, 17/32" long thin hex flange
456-1	2	Flexible coupling
456-4	1	Insulated shaft coupling

Hardware

PART No.	PARTS Per Kit	DESCRIPTION
71-4	5	Ceramic standoff insulator
73-1	1	3/8" rubber grommet
73-2	2	3/4" rubber grommet
73-3	1	7/16" rubber grommet
73-4	1	3/16" rubber grommet
204-9	2	Angle bracket
250-4	6	4-40 x 3/8" RHMS

Hardware (Cont'd.)

PART No.	PARTS Per Kit	DESCRIPTION
250-8	55	#6 sheet metal screw
250-18	17	8-32 x 3/8" RHMS
250-22	1	8-32 x 7/16" setscrew
250-33	2	6-32 x 1/8" setscrew
250-34	4	4-40 x 1/2" RHMS
250-49	12	3-48 x 1/4" PHMS
250-50	10	10-32 x 3/8" PHMS Phillips
250-52	12	4-40 x 1/4" PHMS
250-55	1	10-24 x 4 1/2" RHMS
250-56	64	6-32 x 1/4" PHMS
250-67	1	10-24 x 1 1/8" RHMS Phillips
250-72	3	8-32 x 3/4" RHMS
250-89	21	6-32 x 3/8" PHMS
250-93	26	8-32 x 1/4" Allen setscrew
250-105	4	8-32 x 1/8" Allen setscrew
251-1	22	6-32 spade bolt
252-1	12	3-48 nut
252-2	12	4-40 nut
252-3	87	6-32 nut
252-4	19	8-32 nut
252-7	27	3/8" x 32 control nut
252-9	1	Push-on speed nut
252-14	4	8-32 hex cap nut
252-15	4	4-40 nut (small)
252-30	2	10-24 nut
252-31	1	10-24 wing nut
253-1	4	#6 flat fiber washer
253-3	3	#10 flat fiber washer
253-9	4	#8 cadmium plated washer
253-10	11	3/8" control washer
253-11	9	E washer
253-19	2	#10 metal washer
253-22	5	Metal washer, 1/8" thick
253-36	3	Washer, dished spring brass
253-45	14	Washer, 1/2" OD x 5/32" ID
254-1	120	#6 lockwasher
254-2	22	#8 lockwasher
254-3	2	#10 lockwasher
254-4	19	3/8" control lockwasher
254-5	6	3/8" control lockwasher (thin)
254-7	12	#3 lockwasher
254-9	16	#4 lockwasher
254-13	14	#12 lockwasher
254-15	1	#16 lockwasher
255-1	7	#6 x 1/8" spacer
255-11	4	5/16" x 1" spacer, tapped 6-32
255-21	3	5/16" x 7/8" spacer, tapped 6-32
258-1	3	Spring, dial cord
259-1	4	#6 solder lug
259-2	1	#8 solder lug
259-6	2	#6 solder lug (small)

Sheet Metal Parts

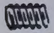
PART No.	PARTS Per Kit	DESCRIPTION
100-M165	1	Pulley, 1 3/4" diameter
100-M166	1	Pulley, 2 1/2" diameter
100-M121	1	Dial pulley, 3 1/2" diameter
100-M159	1	Dial cord, 14 3/4" long
100-M160	1	Dial cord, 20 1/2" long

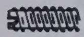
PART No.	PARTS Per Kit	DESCRIPTION
Sheet Metal Parts (Cont'd.)		
100-M161	1	Dial cord, 50 1/2" long
100-M162	1	Shaft and pulley assembly
100-M167	1	Front dial drive plate
100-M168	1	Back dial drive plate
100-M169F	1	Dial pointer bracket
100-M170	1	Antenna coupling dial cord bracket
100-M171	5	Linkage plate, single
100-M172	1	Linkage plate, dual
100-M173	1	Linkage plate, driver
100-M174	1	Linkage plate, slotted
100-M181	1	Main chassis
200-M184	1	VFO subchassis (U bracket)
200-M185	1	VFO subchassis (L bracket)
200-M186	1	Multiplier subchassis (U bracket)
200-M187	1	Multiplier subchassis (L bracket)
203-M160F225	1	Front panel
204-M196	1	Driver mounting bracket
204-M197	1	Meter mounting bracket
204-M198	1	Filter capacitor mounting bracket
204-M199	1	Control shaft support bracket
205-71F	1	Meter escutcheon
100-M131	1	Dial escutcheon
205-M133F242	1	Front panel escutcheon plate
206-M79	1	Driver bottom shield
206-M80	1	Final amplifier housing shield
206-M81	1	Final amplifier back shield
206-M82	1	Final amplifier top shield
206-M83	1	VFO bottom shield
206-M84	1	Multiplier bottom shield
206-M85	1	Driver housing shield
212-M4	2	Connecting silver plated strip
266-M11	1	Linkage arm (long)
266-M12	1	Linkage arm (short)
266-M13	1	Linkage arm (long slotted)
266-M14	1	Linkage arm (short slotted)
266-M205	1	Pinion gear stop
Miscellaneous		
75-25	1	Insulated bracket
89-4	1	Line cord
90-91	1	Cabinet
134-1	1	Cable harness
206-3	2	Tube shield, 2" length
206-25	1	Tube shield, 1 3/4" length
206-43	2	Coaxial connector shield
206-55	1	9-pin miniature socket shield base
207-4	1	Cable clamp
260-12	2	Anode heat dissipation cap
261-6	4	Rubber feet
266-18	1	Rotational stop, 180°
266-19	1	Rotational stop, 90°
340-2	1	Length #20 bare wire
340-3	1	Length #16 bare wire
343-2	1	Short length coax cable
343-5	1	Long length coax cable
344-1	2	Length hookup wire (1-orange, 1-brown)
344-6	1	Length #18 hookup wire

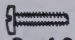
PART No.	PARTS Per Kit	DESCRIPTION
Miscellaneous (Cont'd.)		
345-1	1	Length braid
346-1	1	Length sleeving
390-59	1	Label
391-7	1	"Heathkit" emblem
412-1	4	#47 pilot lamp
412-13	1	Neon lamp (red)
421-4	2	Fuse, 8 amp 3AG
432-3	1	Mike connector
436-4	1	Key jack
436-5	1	Coaxial connector
438-4	4	Phono connector plug
438-6	1	Octal plug
438-11	1	AC fused type plug
440-1	1	Octal plug cap
448-6	2	Adhesive tape strips
463-18	1	Dial pointer
464-9F250	1	Dial plate
490-6	1	5/64" Allen wrench
595-212	1	Instruction manual

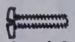
6-32 x 1/8" SET-SCREW—250-33

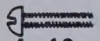
8-32 x 1/8" ALLEN SETSCREW—250-105

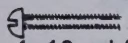

8-32 x 1/4" ALLEN SETSCREW—250-93

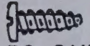

8-32 x 7/16" SET-SCREW—250-22

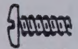

3-48 x 1/4" PHMS 250-49

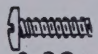

4-40 x 1/4" PHMS 250-52

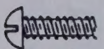

4-40 x 3/8" RHMS 250-4

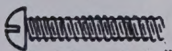

4-40 x 1/2" RHMS 250-34

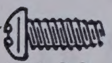

#6 SHEET METAL SCREW—250-8

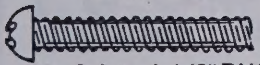

6-32 x 1/4" PHMS 250-56

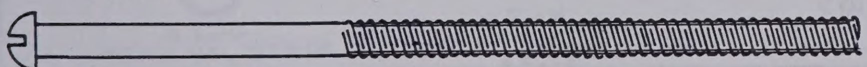

6-32 x 3/8" PHMS 250-89

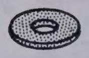

8-32 x 3/8" RHMS 250-18

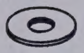

8-32 x 3/4" RHMS 250-72

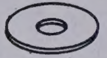

10-32 x 3/8" PHMS 250-50

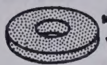

10-24 x 1 1/8" RHMS PHILLIPS 250-67

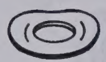

10-24 x 4 1/2" RHMS 250-55

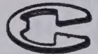

#6 FLAT FIBER WASHER 253-1

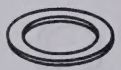

#8 CADMIUM PLATED WASHER 253-9

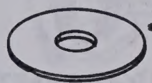

1/2" OD x 5/32" ID WASHER 253-45

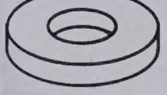

#10 FLAT FIBER WASHER 253-3


DISHED SPRING WASHER 253-36


E WASHER 253-11

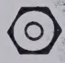

3/8 CONTROL WASHER 253-10

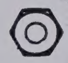

#10 METAL WASHER 253-19

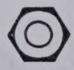

1/8" THICK METAL WASHER 253-22

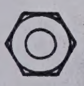
3-48 NUT 252-1

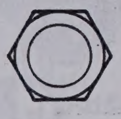
4-40 NUT (SMALL) 252-15

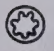

4-40 NUT 252-2

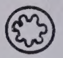

6-32 NUT 252-3

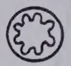

8-32 NUT 252-4

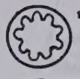

10-24 NUT 252-30

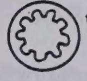

3/8" x 32 CONTROL NUT 252-7

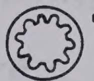

#3 LOCKWASHER 254-7

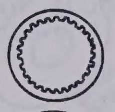

#4 LOCKWASHER 254-9

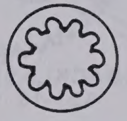

#6 LOCKWASHER 254-1

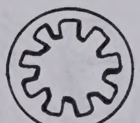

#8 LOCKWASHER 254-2

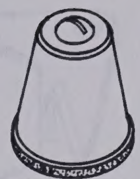

#10 LOCKWASHER 254-3

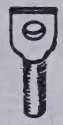

#12 LOCKWASHER 254-13

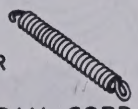

3/8" CONTROL LOCKWASHER (THIN) 254-5

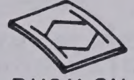

#16 LOCKWASHER 254-15

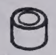

3/8" CONTROL LOCKWASHER 254-4

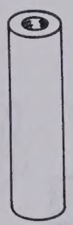

CERAMIC INSULATOR 71-4

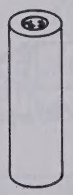

6-32 SPADE BOLT 251-1

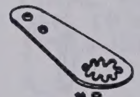

DIAL CORD SPRING 258-1

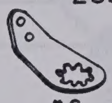

PUSH-ON SPEED NUT 252-9

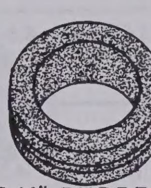

#6 x 1/8 SPACER 255-1

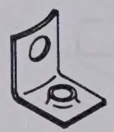

5/16 x 1" SPACER TAPPED 6-32 255-11

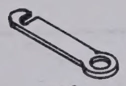

5/16 x 7/8" SPACER TAPPED 6-32 255-21

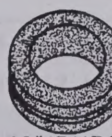

#8 SOLDER LUG 259-2

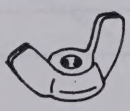

#6 SOLDER LUG 259-1

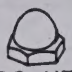

3/4" RUBBER GROMMET — 73-2

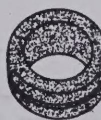

ANGLE BRACKET 204-9

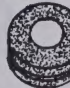

#6 SOLDER LUG SMALL—259-6

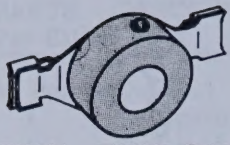

7/16" RUBBER GROMMET—73-3


10-24 WING NUT 252-31

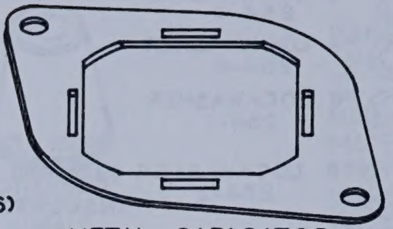

8-32 HEX CAP NUT 252-14


3/8" RUBBER GROMMET 73-1

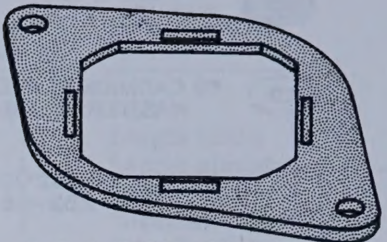

3/16" RUBBER GROMMET—73-4



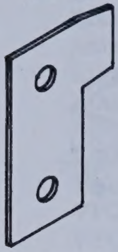
FINAL TANK BAND SWITCH (ROTOR BLADES)
100-M158



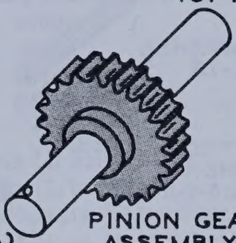
METAL CAPACITOR MOUNTING WAFER
481-1



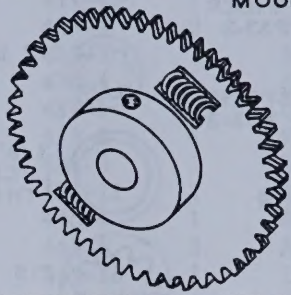
INSULATED CAPACITOR MOUNTING WAFER
481-3



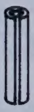
FINAL TANK BAND SWITCH (FIXED PLATES)
205-118



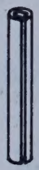
PINION GEAR ASSEMBLY
100-211



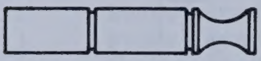
ANTIBACKLASH GEAR
451-16



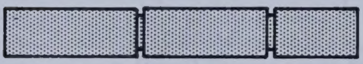
ROLL PIN 7/16" LONG
452-3



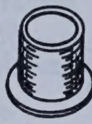
ROLL PIN 3/4" LONG
452-4



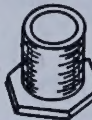
SHAFT, 1 3/8" — 453-56



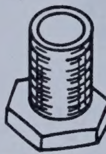
PHENOLIC SHAFT, 1 7/8"
453-64



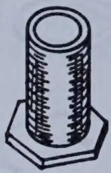
1/4" SHAFT BUSHING
455-6



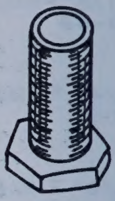
1/4" SHAFT BUSHING
455-13



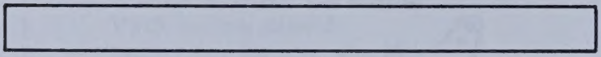
3/8 SHAFT BUSHING
455-10



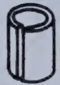
17/32 SHAFT BUSHING
455-26



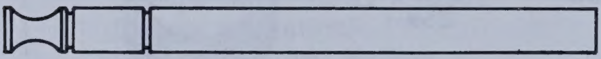
9/16 SHAFT BUSHING
455-17



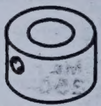
SHAFT, 3 1/8" — 453-65



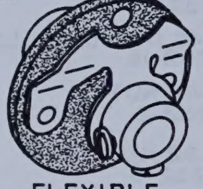
5/16" SPLIT BUSHING
455-11



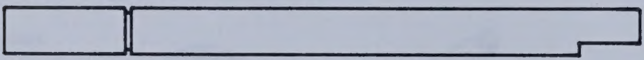
SHAFT, 3 1/8" — 453-62



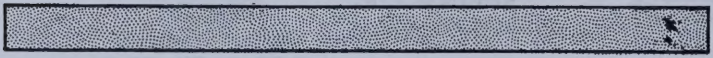
RETAINER BUSHING
455-15



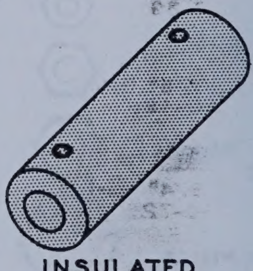
FLEXIBLE COUPLING
456-1



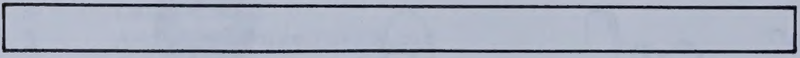
SHAFT, 3 3/8" — 453-57



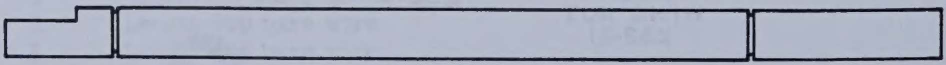
PHENOLIC SHAFT, 3 3/4" — 453-60



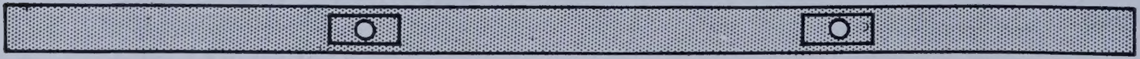
INSULATED SHAFT COUPLING
456-4



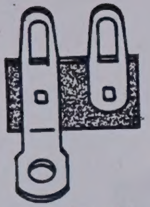
SHAFT, 4 1/4" — 453-61



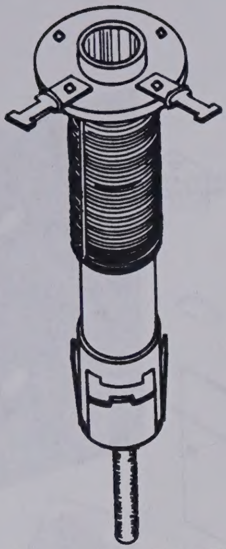
SHAFT, 5" — 453-58



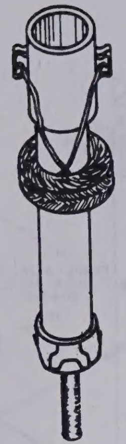
PHENOLIC SHAFT, 6" — 453-63



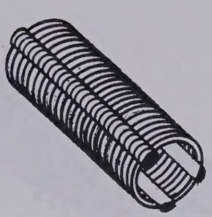
2 LUG
TERMINAL STRIP
431-16



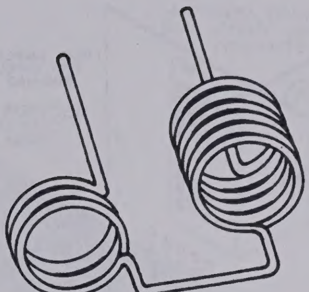
VFO SLUG TUNED
CERAMIC FORM COIL
40-116



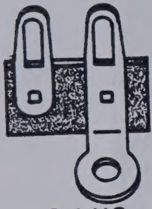
VFO OUTPUT SLUG
TUNED COIL
40-135



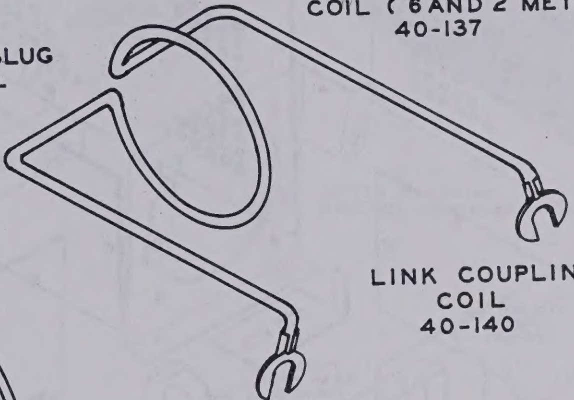
XTAL OSCILLATOR
AIR WOUND COIL
40-136



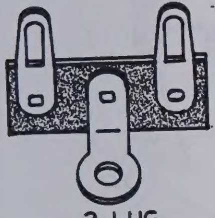
MULTIPLIER PLATE
COIL (6 AND 2 METER)
40-137



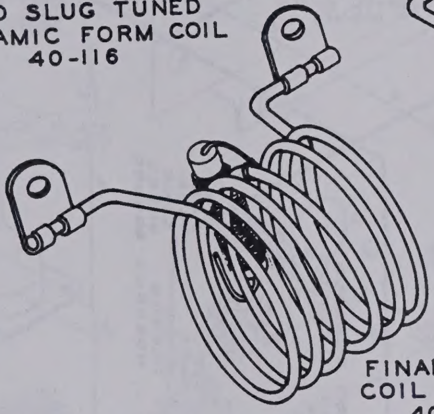
2 LUG
TERMINAL STRIP
431-14



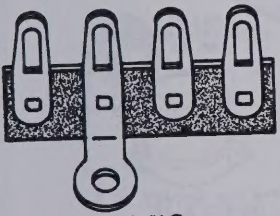
LINK COUPLING
COIL
40-140



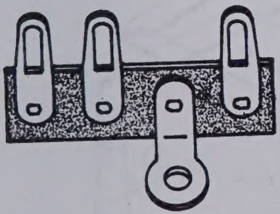
2 LUG
TERMINAL STRIP
431-2



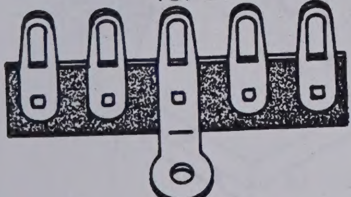
FINAL PLATE
COIL (6 METER)
40-139



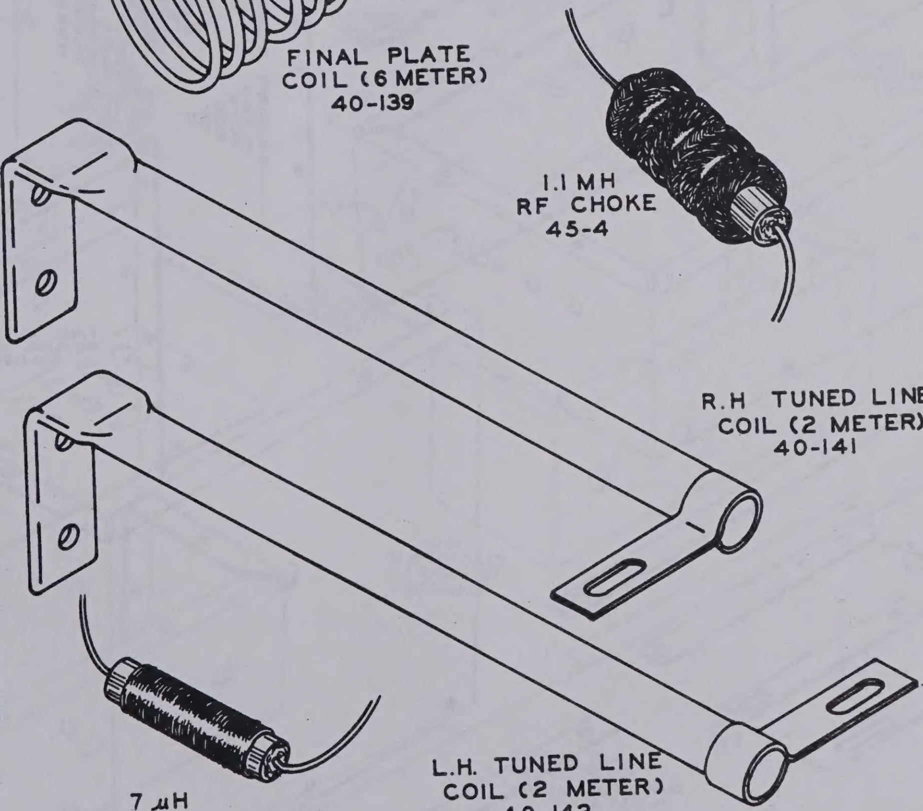
4 LUG
TERMINAL STRIP
431-12



3 LUG
TERMINAL STRIP
431-27



5 LUG
TERMINAL STRIP
431-11

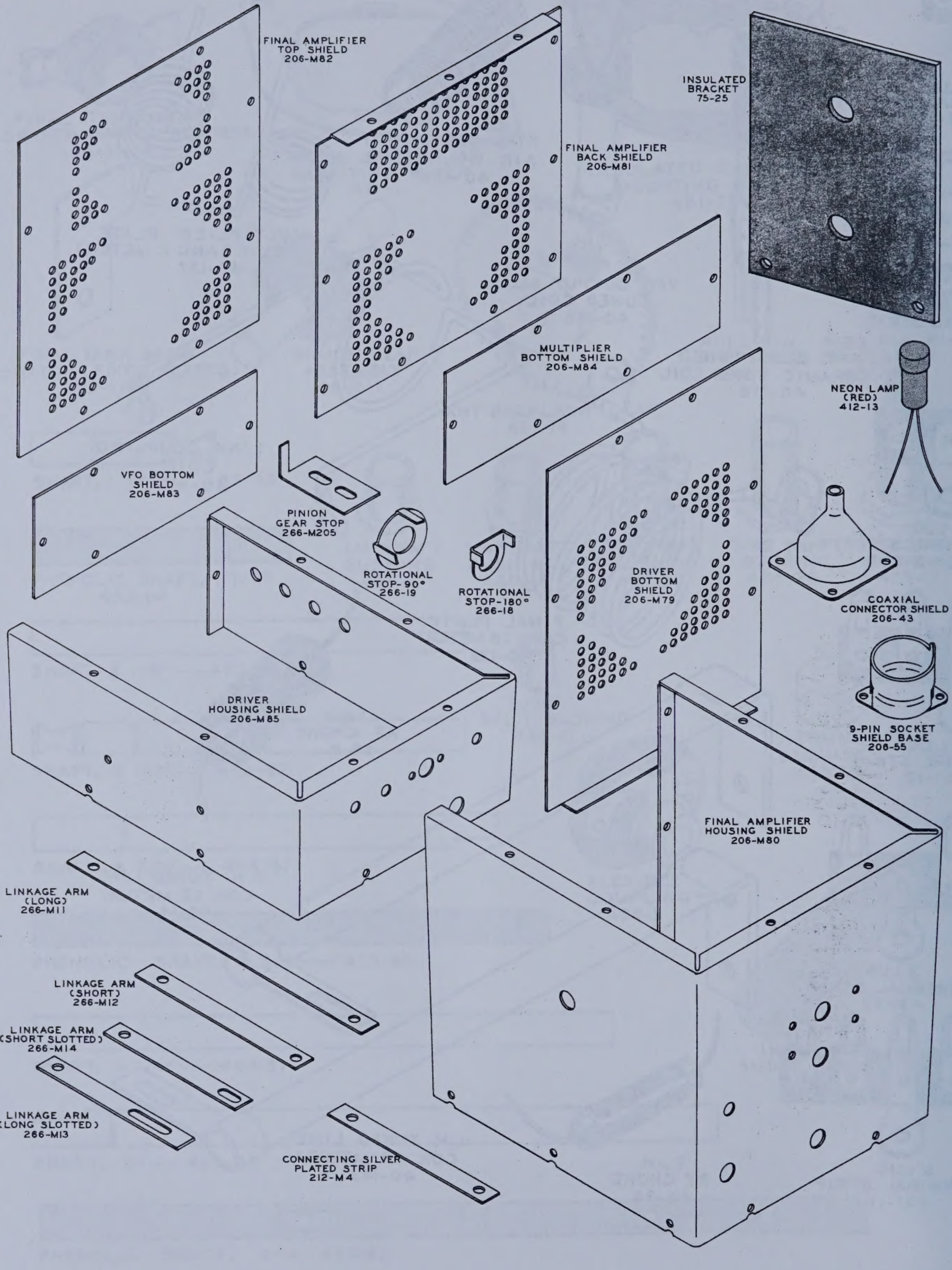


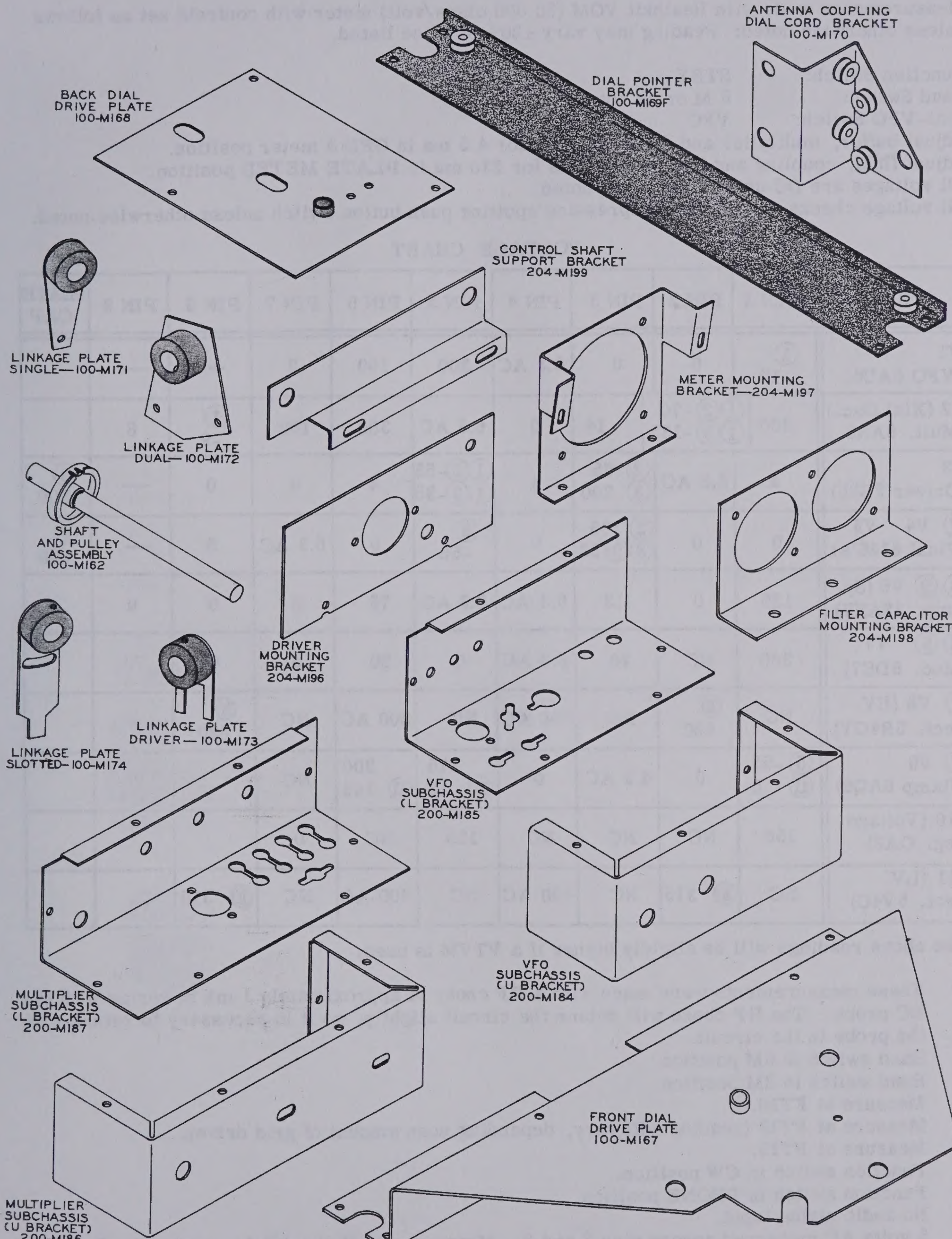
1.1 MH
RF CHOKE
45-4

R.H TUNED LINE
COIL (2 METER)
40-141

L.H. TUNED LINE
COIL (2 METER)
40-142

7 μH
RF CHOKE
45-36


FINAL AMPLIFIER TOP SHIELD 206-M82
FINAL AMPLIFIER BACK SHIELD 206-M81
INSULATED BRACKET 75-25
MULTIPLIER BOTTOM SHIELD 206-M84
NEON LAMP (RED) 412-13
VFO BOTTOM SHIELD 206-M83
PINION GEAR STOP 266-M205
ROTATIONAL STOP-90° 266-19
ROTATIONAL STOP-180° 266-18
DRIVER BOTTOM SHIELD 206-M79
COAXIAL CONNECTOR SHIELD 206-43
9-PIN SOCKET SHIELD BASE 206-55
DRIVER HOUSING SHIELD 206-M85
FINAL AMPLIFIER HOUSING SHIELD 206-M80
LINKAGE ARM (LONG) 266-M11
LINKAGE ARM (SHORT) 266-M12
LINKAGE ARM (SHORT SLOTTED) 266-M14
LINKAGE ARM (LONG SLOTTED) 266-M13
CONNECTING SILVER PLATED STRIP 212-M4


ANTENNA COUPLING DIAL CORD BRACKET 100-M170
BACK DIAL DRIVE PLATE 100-M168
DIAL POINTER BRACKET 100-M169F
CONTROL SHAFT SUPPORT BRACKET 204-M199
LINKAGE PLATE SINGLE—100-M171
METER MOUNTING BRACKET—204-M197
LINKAGE PLATE DUAL—100-M172
SHAFT AND PULLEY ASSEMBLY 100-M162
DRIVER MOUNTING BRACKET 204-M196
FILTER CAPACITOR MOUNTING BRACKET 204-M198
LINKAGE PLATE DRIVER—100-M173
LINKAGE PLATE SLOTTED—100-M174
VFO SUBCHASSIS (L BRACKET) 200-M185
MULTIPLIER SUBCHASSIS (L BRACKET) 200-M187
VFO SUBCHASSIS (U BRACKET) 200-M184
FRONT DIAL DRIVE PLATE 100-M167
MULTIPLIER SUBCHASSIS (U BRACKET) 200-M186

Measurements made with Heathkit VOM (20,000 ohms/volt) meter with controls set as follows unless otherwise noted: Reading may vary ±20% of those listed.

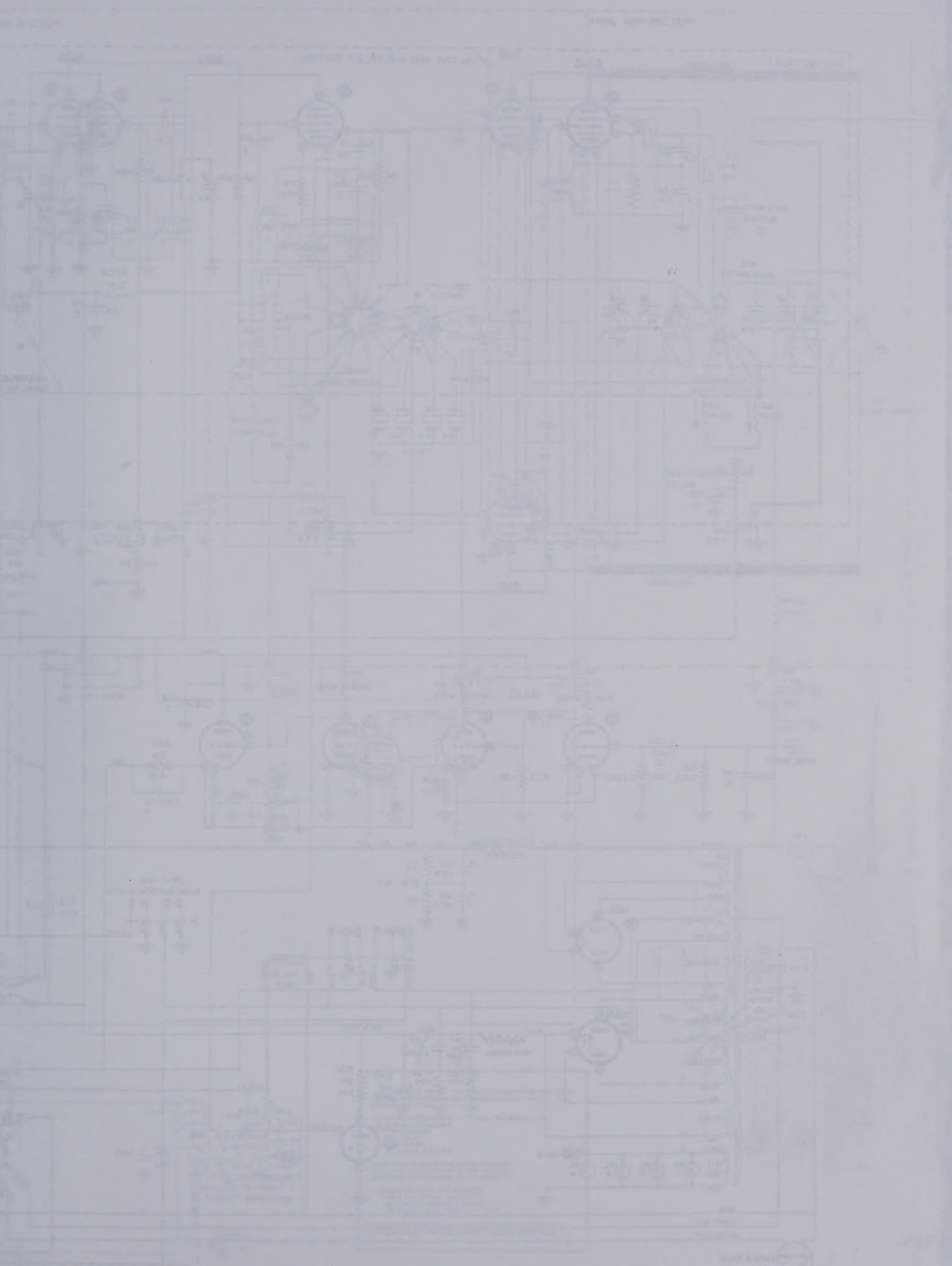
Function Switch: STBY
Band Switch: 6 M or as noted
Xtal-VFO Switch: VFO
Adjust buffer, multiplier and drive controls for 4.5 ma in GRD 3 meter position.
Adjust final, coupling and loading controls for 230 ma in PLATE METER position.
All voltages are DC unless otherwise noted.
All voltage checks are made by depressing spotting push button switch unless otherwise noted.

VOLTAGE CHART

TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PLATE CAP
V1 (VFO 6AU6)	① -12	0	0	6.3 AC	300	150	.2	—	—	
V2 (Xtal Osc.) (Mult. 6AN8)	300	①② -70 ①③ -135	14	0	6.3 AC	300	180	① -9	8	
V3 (Driver 2E26)	4	6.3 AC	② 65 ③ 200	4	①② -55 ①③ -35	4	0	0	—	④ 300
⑦ V4 V5 (Final 6146's)	0	0	② 175 ⑧⑨ 50	0	⑤ -55	0	6.3 AC	0	—	⑥ 600
⑧ ⑨ V6 (Sp. Amp. 12AX7)	125	0	1.3	6.3 AC	6.3 AC	75	.3	0	0	
⑧ ⑨ V7 (Mod. 6DE7)	300	NC	20	6.3 AC	0	20	.5	0	70	
⑦ V8 (HV Rect. 5R4GY)	NC	⑩ 620	NC	800 AC	NC	800 AC	NC	⑩ 620		
⑦ V9 (Clamp 6AQ5)	⑤ -55 ⑪ 0	0	6.3 AC	0	175 ⑪ 15	300 ⑪ 145	NC			
V10 (Voltage Reg. OA2)	150	NC	NC	NC	150	NC	0			
V11 (LV Rect. 5V4G)	NC	⑩ 315	NC	400 AC	NC	400 AC	NC	⑩ 315		

The above readings will be slightly higher if a VTVM is used.

① These measurements were made with a RF choke of approximately 1 mh in series with the DC probe. The RF choke will detune the circuit slightly, so it is necessary to retune with the probe in the circuit.
② Band switch in 6M position.
③ Band switch in 2M position.
④ Measure at FT10.
⑤ Measure at FT13 (reading will vary, depending upon amount of grid drive).
⑥ Measure at FT15.
⑦ Function switch in CW position.
⑧ Function switch in PHONE position.
⑨ No audio signal input.
⑩ 5 volts AC measured across pins 2 and 8. Measure only if absolutely necessary. Be sure function switch is in STBY position when measuring across these pins.
⑪ Key inserted in key jack with key open.


AMP SECTION

Measurements made with Heathkit VOM (20,000 ohms/volt) meter with controls set as follows unless otherwise noted: Reading may vary ±20% of those listed.

Function Switch:	STBY
Band Switch:	6 M or as noted
Xtal-VFO Switch:	VFO

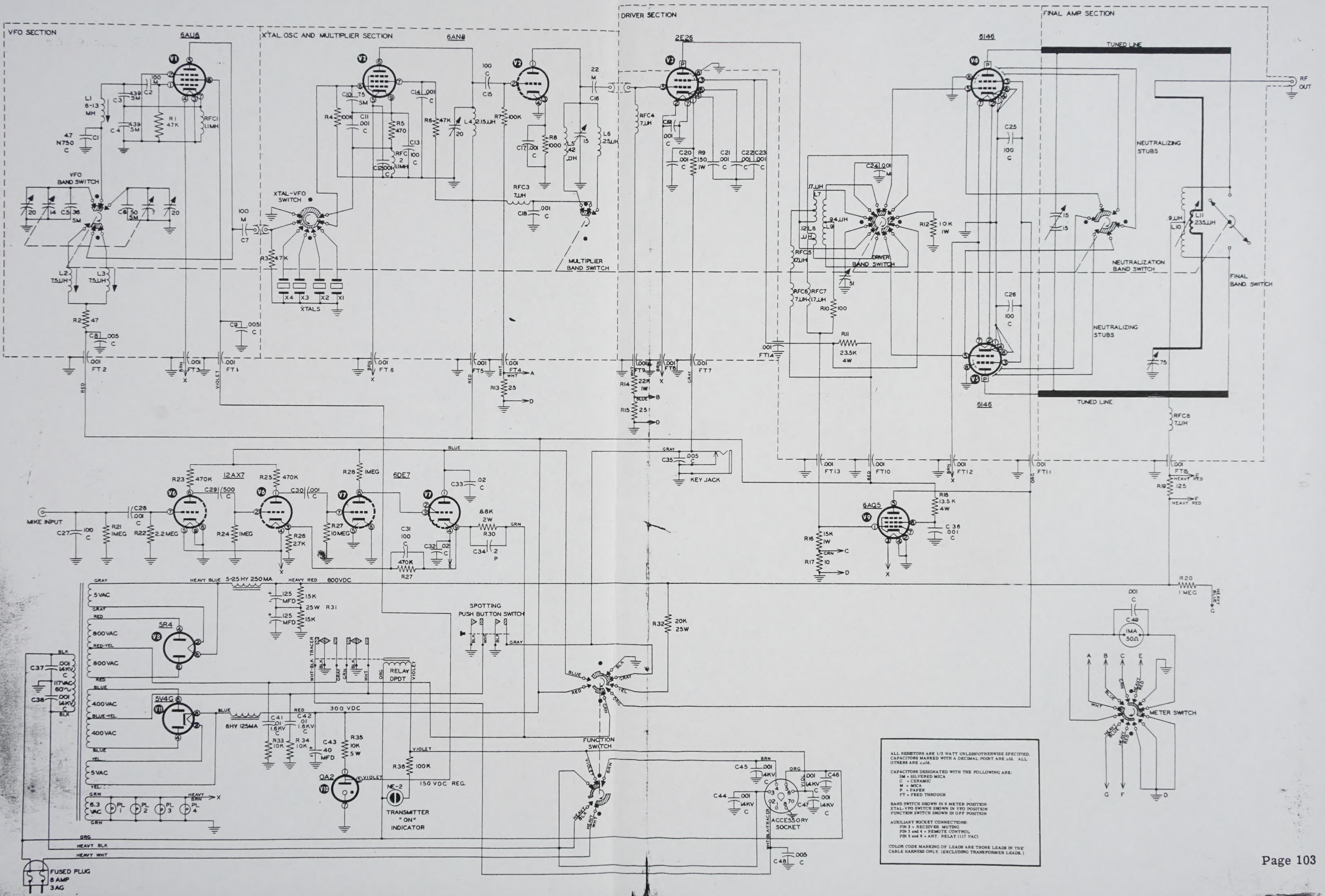
Adjust buffer, multiplier and drive controls for 4.5 ma in GRD 3 meter position.
Adjust final, coupling and loading controls for 230 ma in PLATE METER position.
All voltages are DC unless otherwise noted.
All voltage checks are made by depressing spotting push button switch unless otherwise noted.

VOLTAGE CHART

TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PLATE CAP
V1 (VFO 6AU6)	① -12	0	0	6.3 AC	300	150	.2	—	—	
V2 (Xtal Osc.) (Mult. 6AN8)	300	①② -70 ①③ -135	14	0	6.3 AC	300	180	① -9	8	
V3 (Driver 2E26)	4	6.3 AC	② 65 ③ 200	4	①② -55 ①③ -35	4	0	0	—	④ 300
⑦ V4 V5 (Final 6146's)	0	0	② 175 ⑧⑨ 50	0	⑤ -55	0	6.3 AC	0	—	⑥ 600
⑧ ⑨ V6 (Sp. Amp. 12AX7)	125	0	1.3	6.3 AC	6.3 AC	75	.3	0	0	
⑧ ⑨ V7 (Mod. 6DE7)	300	NC	20	6.3 AC	0	20	.5	0	70	
⑦ V8 (HV Rect. 5R4GY)	NC	⑩ 620	NC	800 AC	NC	800 AC	NC	⑩ 620		
⑦ V9 (Clamp 6AQ5)	⑤ -55 ⑪ 0	0	6.3 AC	0	175 ⑪ 15	300 ⑪ 145	NC			
V10 (Voltage Reg. OA2)	150	NC	NC	NC	150	NC	0			
V11 (LV Rect. 5V4G)	NC	⑩ 315	NC	400 AC	NC	400 AC	NC	⑩ 315		

The above readings will be slightly higher if a VTVM is used.

① These measurements were made with a RF choke of approximately 1 mh in series with the DC probe. The RF choke will detune the circuit slightly, so it is necessary to retune with the probe in the circuit.
② Band switch in 6M position.
③ Band switch in 2M position.
④ Measure at FT10.
⑤ Measure at FT13 (reading will vary, depending upon amount of grid drive).
⑥ Measure at FT15.
⑦ Function switch in CW position.
⑧ Function switch in PHONE position.
⑨ No audio signal input.
⑩ 5 volts AC measured across pins 2 and 8. Measure only if absolutely necessary. Be sure function switch is in STBY position when measuring across these pins.
⑪ Key inserted in key jack with key open.


VFO SECTION
6AU6
V1
L1 6-13 MH
C3 439 SM
C4 439 SM
.100 M C2
R1 47K
RFC1 1.1MH
47 N750 C
C1
VFO BAND SWITCH
20
14
C5 36 SM
C6 50 SM
7
20
L2 7.5µH
L3 7.5µH
R2 47
C8 .005 C
C9 .005 C
.001 FT2
.001 FT3
.001 FT1
XTAL OSC AND MULTIPLIER SECTION
6AN8
V2
C10 75 SM
C11 .001 C
R4 100K
R5 470
RFC2 1.1MH
C12 .001 C
C13 100 C
C14 .001 C
R6 47K
L4 2.15µH
20
100 C C15
R7 100K
R8 1000
C17 .001 C
XTAL-VFO SWITCH
100 M C7
R3 47K
X4 X3 X2 X1
XTALS
RFC3 7µH
C18 .001 C
22 M C16
L5 .42 µH
15
L6 .25µH
MULTIPLIER BAND SWITCH
.001 FT6
.001 FT5
.001 FT4
R13 25
DRIVER SECTION
2E26
V3
RFC4 7µH
C19 .001 C
C20 .001 C
R9 150 1W
C21 .001 C
C22 .001 C
C23 .001 C
C24 .001 M
L7 .17µH
L8 .12µH
L9 .94µH
RFC5 7µH
RFC6 7µH
RFC7 17µH
DRIVER BAND SWITCH
51
R10 100
R11 23.5K 4W
R12 10K 1W
.001 FT14
.001 FT9
.001 FT8
.001 FT7
R14 22K 1W
R15 25
FINAL AMP SECTION
6146
V4
V5
TUNED LINE
C25 100 C
C26 100 C
NEUTRALIZING STUBS
15
15
NEUTRALIZATION BAND SWITCH
L10 .9µH
L11 .235µH
FINAL BAND SWITCH
RF OUT
75
RFC8 7µH
.001 FT13
.001 FT10
.001 FT12
.001 FT11
.001 FT15
R19 125
HEAVY RED
C35 .005 C
KEY JACK
12AX7
V6
6DE7
V7
MIKE INPUT
C27 100 C
R21 1MEG
C28 .001 C
R22 2.2 MEG
R23 470K
C29 500 C
R24 1MEG
R25 470K
C30 .001 C
R26 2.7K
R27 10MEG
R28 1MEG
C31 100 C
470K R27
C32 .02 C
C33 .02 C
6.8K 2W R30
C34 2 P
6AQ5
V9
R16 15K 1W
R17 10
R18 13.5K 4W
C36 .001 C
5-25 HY 250 MA
600VDC
125 MFD
15K 25W R31
125 MFD 15K
5VAC
900VAC
800VAC
5R4
V8
C37 .001 14KV C
C38 .001 14KV C
117VAC 60~
400VAC
400VAC
5V4G
V11
6HY 125MA
C41 .01 1.6KV C
C42 .01 1.6KV C
300 VDC
R33 10K
R34 10K
C43 40 MFD
R35 10K 5W
R36 100K
150 VDC REG.
OA2
V10
NE-2
TRANSMITTER "ON" INDICATOR
5VAC
6.3 VAC
PL 1 PL 2 PL 3 PL 4
SPOTTING PUSH BUTTON SWITCH
RELAY DPDT
R32 20K 25W
FUNCTION SWITCH
C45 .001 14KV C
C46 .001 14KV C
C44 .001 14KV C
C47
ACCESSORY SOCKET
C48 .005 C
R20 1 MEG
.001 C
C49
1MA 50Ω
METER SWITCH
FUSED PLUG 8 AMP 3AG

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED. CAPACITORS MARKED WITH A DECIMAL POINT ARE µfd. ALL OTHERS ARE µµfd.

CAPACITORS DESIGNATED WITH THE FOLLOWING ARE:
- SM = SILVERED MICA
- C = CERAMIC
- M = MICA
- P = PAPER
- FT = FEED THROUGH

BAND SWITCH SHOWN IN 6 METER POSITION
XTAL-VFO SWITCH SHOWN IN VFO POSITION
FUNCTION SWITCH SHOWN IN OFF POSITION

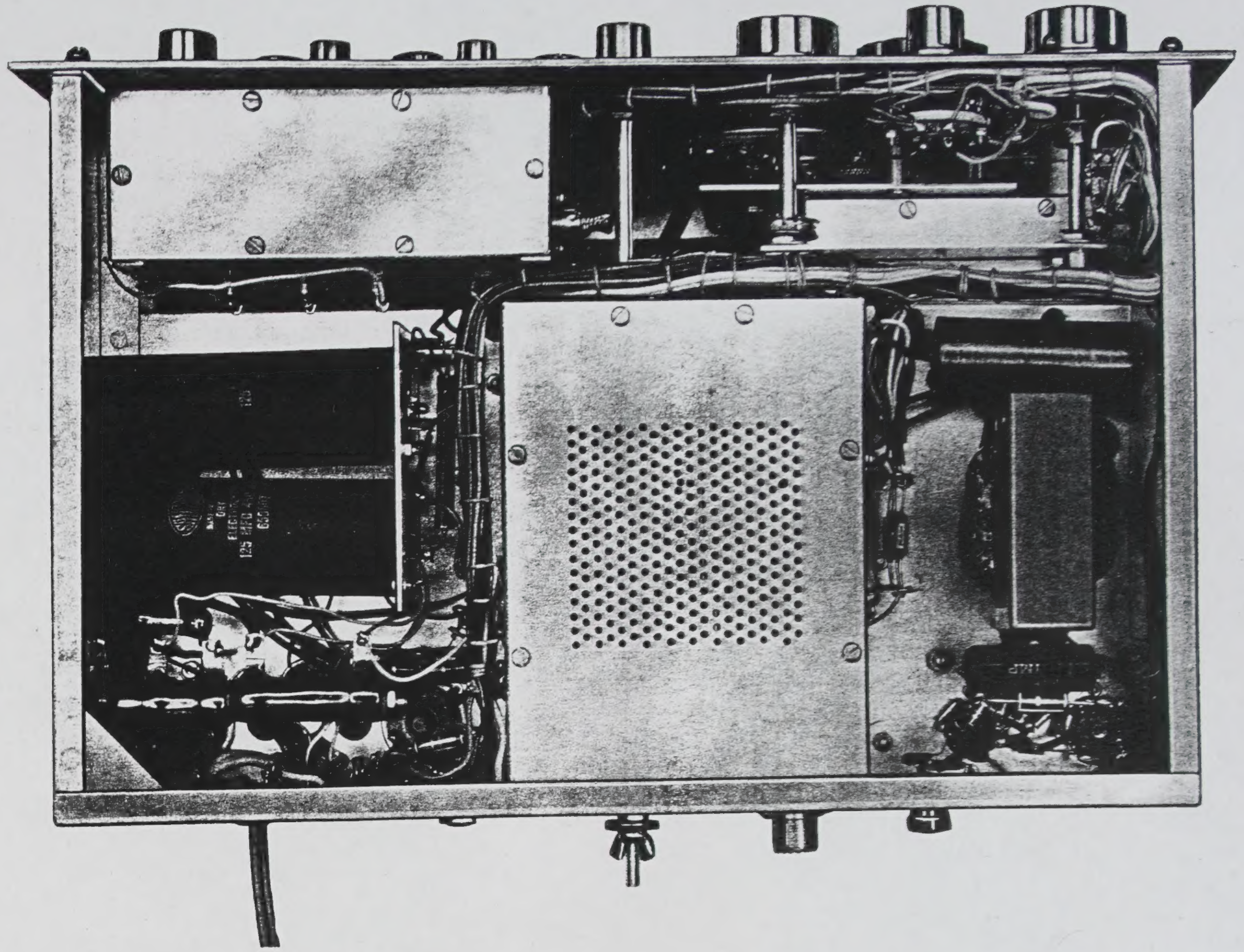
AUXILIARY SOCKET CONNECTIONS:
- PIN 2 = RECEIVER MUTING
- PIN 3 and 4 = REMOTE CONTROL
- PIN 5 and 6 = ANT. RELAY (117 VAC)

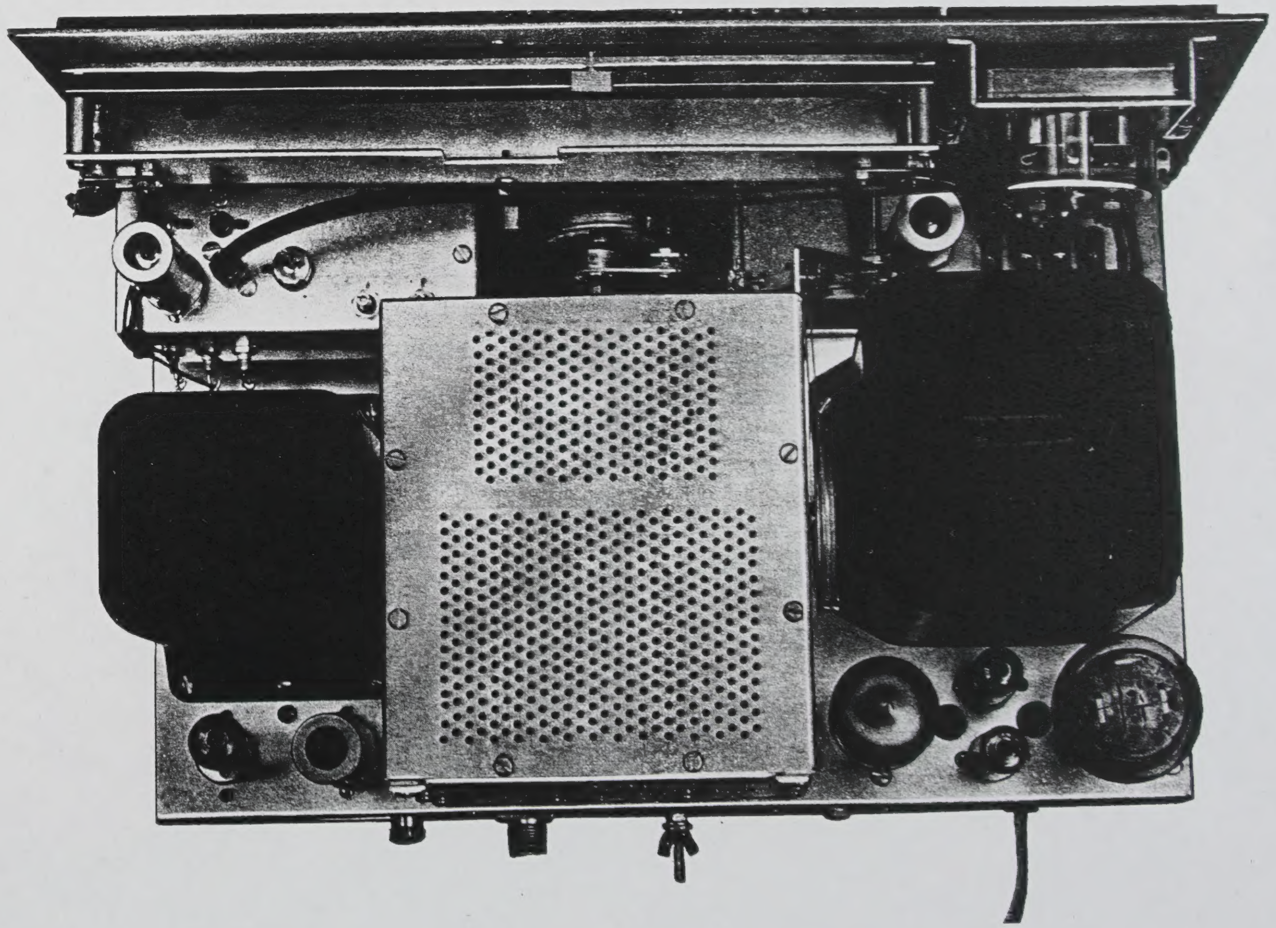
COLOR CODE MARKING OF LEADS ARE THOSE LEADS IN THE CABLE HARNESS ONLY. (EXCLUDING TRANSFORMER LEADS.)

FREQUENCY CHART TABLE #1

6-METER BAND		2-METER BAND	
VFO OR CRYSTAL FREQUENCY	DIAL READING AND OUTPUT FREQUENCY	VFO OR CRYSTAL FREQUENCY	DIAL READING AND OUTPUT FREQUENCY
8.334 MC	50.0 MC	8.000 MC	144.0 MC
8.350	50.1	8.005	144.1
8.366	50.2	8.011	144.2
8.383	50.3	8.016	144.3
8.400	50.4	8.022	144.4
8.416	50.5	8.027	144.5
8.433	50.6	8.033	144.6
8.450	50.7	8.038	144.7
8.466	50.8	8.044	144.8
8.483	50.9	8.050	144.9
8.500	51.0	8.055	145.0
8.516	51.1	8.061	145.1
8.533	51.2	8.066	145.2
8.550	51.3	8.072	145.3
8.566	51.4	8.077	145.4
8.583	51.5	8.083	145.5
8.600	51.6	8.088	145.6
8.616	51.7	8.094	145.7
8.633	51.8	8.100	145.8
8.650	51.9	8.105	145.9
8.666	52.0	8.111	146.0
8.683	52.1	8.116	146.1
8.700	52.2	8.122	146.2
8.716	52.3	8.127	146.3
8.733	52.4	8.133	146.4
8.750	52.5	8.138	146.5
8.766	52.6	8.144	146.6
8.783	52.7	8.150	146.7
8.800	52.8	8.155	146.8
8.816	52.9	8.161	146.9
8.833	53.0	8.166	147.0
8.850	53.1	8.172	147.1
8.866	53.2	8.177	147.2
8.883	53.3	8.183	147.3
8.900	53.4	8.188	147.4
8.916	53.5	8.194	147.5
8.933	53.6	8.200	147.6
8.950	53.7	8.205	147.7
8.966	53.8	8.211	147.8
8.983	53.9	8.216	147.9
9.000	54.0	8.222	148.0

145.44





HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

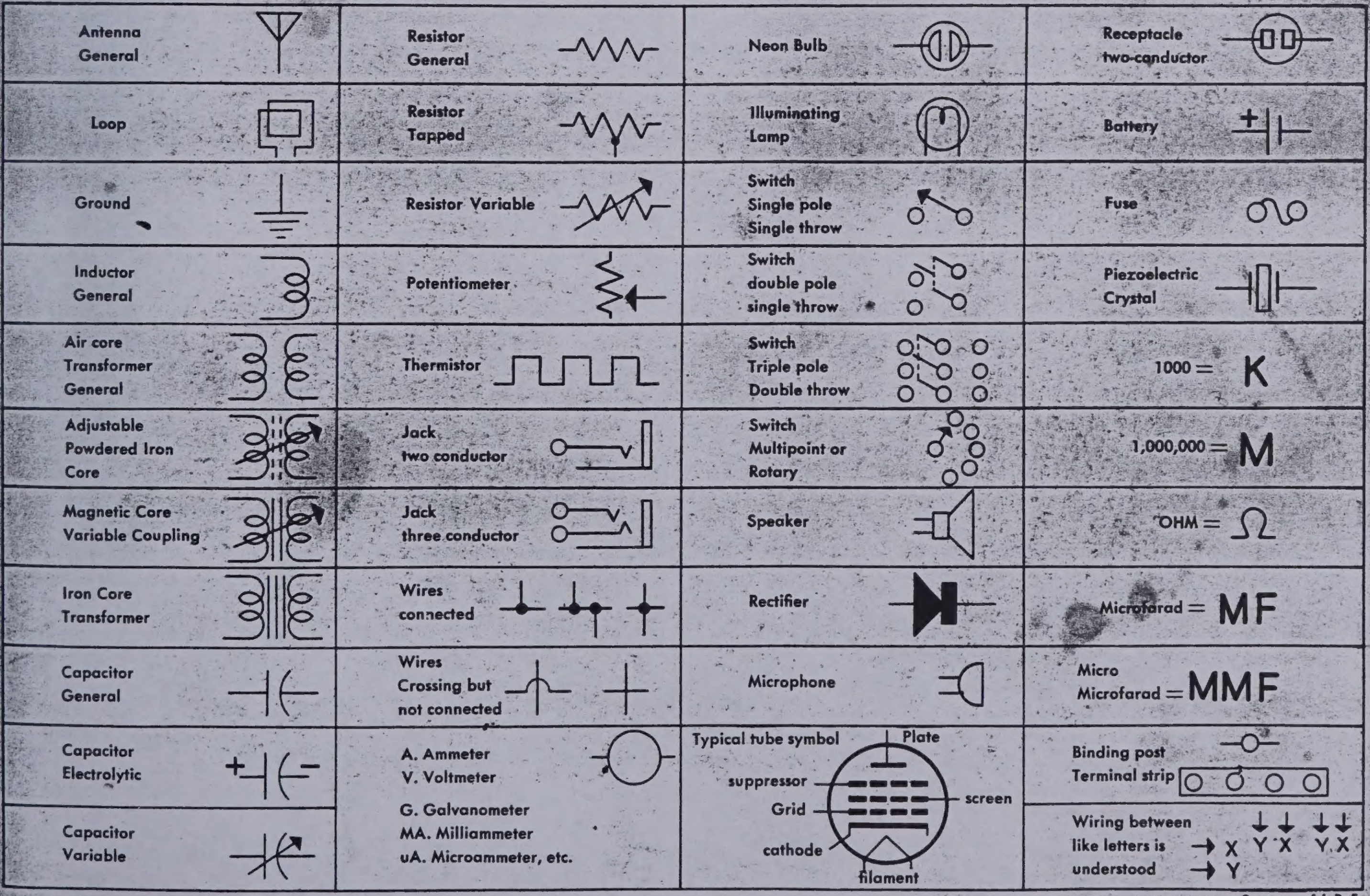
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.


Antenna General
Loop
Ground
Inductor General
Air core Transformer General
Adjustable Powdered Iron Core
Magnetic Core Variable Coupling
Iron Core Transformer
Capacitor General
Capacitor Electrolytic
+
Capacitor Variable
Resistor General
Resistor Tapped
Resistor Variable
Potentiometer
Thermistor
Jack two conductor
Jack three conductor
Wires connected
Wires Crossing but not connected
A. Ammeter
V. Voltmeter
G. Galvanometer
MA. Milliammeter
uA. Microammeter, etc.
Neon Bulb
Illuminating Lamp
Switch Single pole Single throw
Switch double pole single throw
Switch Triple pole Double throw
Switch Multipoint or Rotary
Speaker
Rectifier
Microphone
Typical tube symbol
Plate
suppressor
Grid
screen
cathode
filament
Receptacle two-conductor
Battery
+
Fuse
Piezoelectric Crystal
1000 = K
1,000,000 = M
OHM = Ω
Microfarad = MF
Micro Microfarad = MMF
Binding post
Terminal strip
Wiring between like letters is understood
X
Y
Y X
Y X

Courtesy of I. R. E.

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